### UNCLASSIFIED

### AD NUMBER AD872180 **NEW LIMITATION CHANGE** TO Approved for public release, distribution unlimited **FROM** Distribution authorized to U.S. Gov't. agencies and their contractors; Critical Technology; APR 1970. Other requests shall be referred to Naval Sea Systems Command, ATTN: AIR-530214, Washington, DC 20360. **AUTHORITY** USNASC 1tr dtd 26 Oct 1971



CONTRACT NO. 00019-69-C-0427

### COLLOCATION FLUTTER ANALYSIS STUDY II

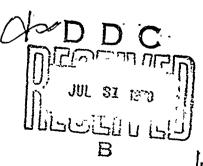
THIS DOCUMENT IS SUBJECT TO SPECIAL EXPORT CONTROLS AND TRANSMITTAL TO FOREIGN GOVERNMENTS OR FOREIGN NATIONALS MAY BE MADE ONLY WITH PRIOR APPROVAL OF THE NAVAL AIR SYSTEMS COMMAND (AIR-530214).

### **VOLUME II**

UNSTEADY AERODYNAMIC GENERALIZED FORCE PROGRAMS FOR SUBSONIC, TRANSONIC, AND SUPERSONIC FLIGHT REGIMES

**APRIL 1970** 





102

### COFA II

### COLLOCATION FLUTTER ANALYSIS STUDY II

### VOLUME II

UNSTEADY AÉRODYNAMIC GENERALIZED FÖRCE PROGRAMS FOR SUBSONIC, TRANSONIC, AND SUPERSONIC FLIGHT REGIMES

PREPARED BY DYNAMICS & ENVIRONMENTS SECTION PERSONNEL, HUGHES
AIRCRAFT COMPANY, MISSILE SYSTEMS DIVISION, CONTRACT NO. 00019-69-C-0427

**APRIL 1970** 

This document is subject to special export controls and transmittal to foreign governments or foreign nationals may be made only with prior approval of the Naval Air Systems Command (AIR-530214).

Wash, D.C. 20360



### TABLE OF CONTENTS

Section		Page No.
1.0.	Introduction	1
2.0	Unsteady Aerodynamics Generalized Forces	2.
3.0	Subsonic Unsteady Aerodynamics Program	4
	3.1 Theoretical Derivation	4
	3.2 Program Description	7
	3.3 Input Instructions	<b>10</b>
	3.4 Sample Problem	15
	3.5 Program Listing	22
4.0	Transonic Unsheady Aerodynamics Program	38
	4.1 Theoretical Derivation	38
	4.2 Program Description	41
	4.3 Input Instructions	- 44
	4.4 Sample Problem	48
	4.5 Program Listing	56
5.0	Supersonic Unsteady Aerodynamics Program	69
	5.1 Theoretical Derivation	69
	5.2 Program Description	73
_	5.3 Input Instructions	76
-	5.4 Sample Problem	80
	5.5 Program Listing	88
6 <b>.</b> 0	References	99

### 1.0 INTRODUCTION

The flutter problem can be solved with either a collocation or normal-mode formulation. The collocation approach is attractive if an accurate stiffness and aerodynamic influence coefficient matrix can be formed for the system. The normal-mode method merits consideration when mode shapes and natural frequencies for the structure are known. The normal-mode method requires the aerodynamics to be presented as generalized forces. The normal-mode formulation is generally presented in the following manner

$$(\overline{M}] + [\overline{Q}] - \frac{1+ig}{\omega^2} \left[ \frac{\omega}{n} \right] \left[ \overline{M} \right] = 0$$

Where

[M] = Generalized Mass Matrix

[Q] = Generalized Aerodynamic Force Matrix

g - Artifical Structural Damping

 $\omega$  = Flutter Frequency

 $\omega_n$  = Natural Vibration Frequency

 $\psi$  = Generalized' Coordinate

This volume presents three computer programs that calculate the generalized aerodynamic forces for the three flight regimes: Subsonic Flight, Transonic Flight, Supersonic Flight and may be used with the Modal Flutter Analysis Program of Vol. III. The subsonic program is based upon Kernel Function formulation. The transonic and supersonic programs are based upon the Mach Box technique.

### 2.0 UNSTEADY AERODYNAMIC GENERALIZED FORCES

The generalized force  $Q_{ij}$  is defined as the work done in mode 1 by the pressures due to motion of mode j. If  $z^i(x,y)$  is the deformation pattern of mode i and  $\Delta^p_j$  (x,y) is the pressure distribution of mode j then

$$\hat{Q}_{ij} = \int \int z^{i}(x_{ij}y) \Delta P_{j}(x,y) dxdy \qquad 2.0.1$$

Oscillation of a lifting surface creates a phase lead (or lag) between the pressure and motion of the surface thereby making Q<sub>ij</sub> a complex quantity.

The frequency dependency of the generalized force makes the flutter solution a trial and error procedure. Different frequencies must be tried until the flutter frequency and the generalized force frequency coincides. Fortunately, the flutter frequencies are usually near the natural frequencies. This is especially true for a stable structure with modes which remain fairly uncoupled; there is little drifting of oscillatory frequencies with the presence of aerodynamic forces.

Various lifting surface theories were employed to determine the pressure distribution  $\Delta P_j(x,y)$  for generalized force calculations. This was required to correctly account for the high degree of chordwise and spanwise deformation associated with mode shapes of low aspect ratio surfaces. Also, it was necessary to include aerodynamic interaction effects between tandem surfaces.

The methods are based on the linearized equation of fluid motion which describe the flow patterns for a compressible, inviscid, isentropic and irrotational fluid. The boundary conditions are consistent with thin wing theory. The effects of high angles of attack and missile body influence on the aerodynamics of the lifting surfaces were not considered in the analysis.

The linearized equation for time dependent disturbances is

$$\overline{\phi}_{XX} + \overline{\phi}_{YY} + \overline{\phi}_{ZZ} = M^2 (\overline{\phi}_{XX} + \frac{2}{U} \overline{\phi}_{XT} + \frac{1}{U} \overline{\phi}_{TT})$$
 2.0.2

where  $\bar{\phi}$  is the perturbation velocity potential at the point (X, Y, Z). M and U are the free stream Mach number and velocity, respectively. Imposing the requirement of harmonic motion, this time dependency can be expressed as

$$\frac{1}{\phi} = b\phi e^{-\frac{1}{2}\omega t}$$

where  $\phi$  is the nondimensional complex amplitude of the velocity potential and b is a reference semi-chord. The equation may be cast in a nondimensional form by substitution of the following dimensionless parameters:

$$x = X/b$$

$$y = Y/b$$

$$z = Z/b$$

This yields

D PARTY.

$$\phi_{xx} + \phi_{yy} + \phi_{zz} = M^2 (\phi_{xx} + 2ik \phi_{x} - k^2 \phi)$$
 2.0.3

It is this relationship which must be satisfied for M<1, M=1, and M>1. A brief description of the analytical techniques employed for each speed regime is presented in the following sections. The numerical and computational schemes used are similar to those which are described in detail it. References 5, 6, and 7.

### 3.0 SUBSONIC UNSTEADY AERODYNAMICS PROGRAM

### 3.1 Theoretical Derivation

Subsonic aerodynamic loads were derived by the kernel function method and the resulting loads were then used to compute generalized forces. The subsonic kernel function relationship for the downwath (x,y) on a surface in terms of the pressure over the entire surface is

$$w(x,y) = -\frac{1}{8\pi} \iint \frac{\Delta P}{1/2\rho u^2} K(x-\xi, y-\eta) d\xi d\eta$$
 3.1.1

This relationship is derived by noting that the potential equation for subsonic flow,

$$(1-M^2)\phi_{xx} + \phi_{yy} + \phi_{zz} = M^2 (2ik\phi_x - k^2\phi)$$
 3.1.2

is satisfied at (x,y,z) by the pulsating pressure doublet

$$\phi = -A \frac{\partial}{\partial \zeta} e^{-ik(x-\xi)} \int_{-\infty}^{x-\xi} \frac{1}{R!} \exp \left[ \frac{ik}{1-k!^2} (\lambda - MR!) \right] d\lambda \qquad 3.1.3$$

where

$$R' = \sqrt{\lambda^2 + (1-M^2) (y-\eta)^2 + (z-\xi)^2}$$
3.1.4

and the pressure doublet strength is given by

$$A = \frac{1}{4\pi} \left[ \begin{array}{c} \Delta P & (\xi, \eta) \\ 1/2 \rho v^2 \end{array} \right] d\xi d\eta \qquad 3.1.5$$

The velocity normal to the lifting surface is given by

$$w(x,y) = \lim_{z \to 0} \frac{\partial \phi}{\partial z}$$
3.1.6

Substituting equation (3.1.3) into the equation above and integrating over the area yields the kernel function relationship, equation (3.1.1). For tandem surfaces, the integration extends over both surfaces:

$$w(x,y) = -\frac{1}{8\pi} \int_{s}^{ts} \int_{1.e.}^{t.e.} \frac{\Delta P_{W(\xi,\eta)}}{1/2\rho u^2} K(x-\xi, y-\eta) d\xi d\eta$$

$$-\frac{1}{8\pi} \int_{-s}^{ts} \int_{1.e.}^{t.e.} \frac{\Delta P_{cs}(\xi,\eta)}{1/2\rho u^2} K(x-\xi, y-\eta) d\xi d\eta$$

$$control surface$$

$$3.1.7$$

4

The kernel function at any point is given by

$$K(x-\xi,y-\eta) = \lim_{\substack{\zeta \to 0 \\ z \to 0}} \left\{ e^{-ik(x-\xi)} \frac{\partial}{\partial z} \frac{\partial}{\partial \zeta} \int_{-\infty}^{x-\xi} \frac{1}{R^{i}} e^{-i\left[\frac{1}{1-M^{2}}(\lambda-MR^{i})\right]} d\lambda \right\}$$
(3.1.8)

Equation (3.1.7) then represents the integral equation wherein given the downwash w(x,y) over the wing and control surface,  $\Delta P_w$  and  $\Delta P_{cs}$  must then be determined.

The pressure distribution is approximated as the sum of a series of functions which have the proper behavior as inferred from steady state and two-dimensional solutions. The pressure on each surface can be approximated in the form

$$\Delta P = \frac{1}{2} \rho U^{2} \sqrt{\frac{s^{2} - n^{2}}{b(\hat{n})}} \sum_{n=0}^{N} \sum_{m=0}^{M} a_{nm} P_{m} (\underline{n}) f_{n} (\xi)$$
 (3.1.9)

where

$$f_{0}(\tilde{\xi}) = \sqrt{1 - \tilde{\xi}^{2}} \qquad f_{n}(\tilde{\xi}) = \sqrt{1 - \tilde{\xi}^{2}} \qquad T_{n-1}(\tilde{\xi}); \quad n \ge 1$$

$$P_{o}(\underline{n}) = 1.0$$
  $P_{m}(\underline{n}) = \underline{n}^{2} T_{\underline{m}-\underline{1}}(\underline{\hat{n}}); \quad \underline{\hat{n}} \geq 1$  (3.1.10)

$$T_0(x) = 1.0$$

$$T_1(x) = 2x$$

$$T_{k}(x) = 2xT_{k-1}(x) - T_{k-2}(x); k \ge 2$$

$$\tilde{\xi} = \frac{\xi - \overline{\xi}}{b (\eta)}$$

$$\tilde{\xi} = 1/2 (\xi_{1.e.} + \xi_{t.e.})$$

$$\underline{\eta} = \frac{\eta}{s}$$

s is the starboard coordinate of the surface tip and b  $(\eta)$  is the local semi-chord. The functions T are Chébyshev polynomials and are introduced for purposes of convenience.

Substituting equation (3.1.8, 3.1.9, and 3.1.10) into equation (3.1.7) yields a set of equations relating the pressure coefficients for the wing,  $a_{nm}^W$ , and the control surface,  $a_{nm}^{CS}$ , to the downwashes. In matrix notation this gives

The integrals involved in evaluating the D's were solved by the methods of Hsu (Reference 5). In this procedure the integrals are numerically evaluated using the Gauss-Mehler quadrature. Upon determining values for the D's, the pressure coefficients are found by direct inversion and the generalized forces are found by application of equation (2.0.1).

### 3.2 Program Description.

The Subsonic Generalized Force Unsteady Aerodynamics Program calculates generalized forces for up to 10 deformation modes. The computer solution, which is based upon the kernel function formulation, is applicable to a variety of configurations. The various configurations which can be analyzed are shown in Figure 3.2.1 and Table 3.2.2. The analysis includes interaction effects between tandem surfaces and wake effects on the trailing surface. The number of integration stations are chosen, and they are automatically located. The collocation stations are then interdigitated between the integration stations, according to Hsu (Reference 5), internally in the program. The solutions at the collocation stations are then matched to terms in the downwash series by a least squares method and the surface pressure are determined. The method of solution programmed does not allow for a single surface to be analyzed separately; however, an option to isolate and eliminate interference effects between the two surfaces is available. Thus, a single surface can be analyzed by using the option ISOLAT and inputing a dummy second surface.

The solution for the generalized aerodynamic forces requires the input of the deformation modes due to vibration. The program considers the modes to be expressed as analytic functions of the form:

$$W(x, y) = \sum_{m=0}^{N} \sum_{m=0}^{n} C_{(n-m), m} x^{(n-m)} y^{m}$$

To meet this requirement only the coefficients "c" are required as input into the program. These coefficients can be obtained in several ways, the most common way is to surface fit the modes by the least-square technique.

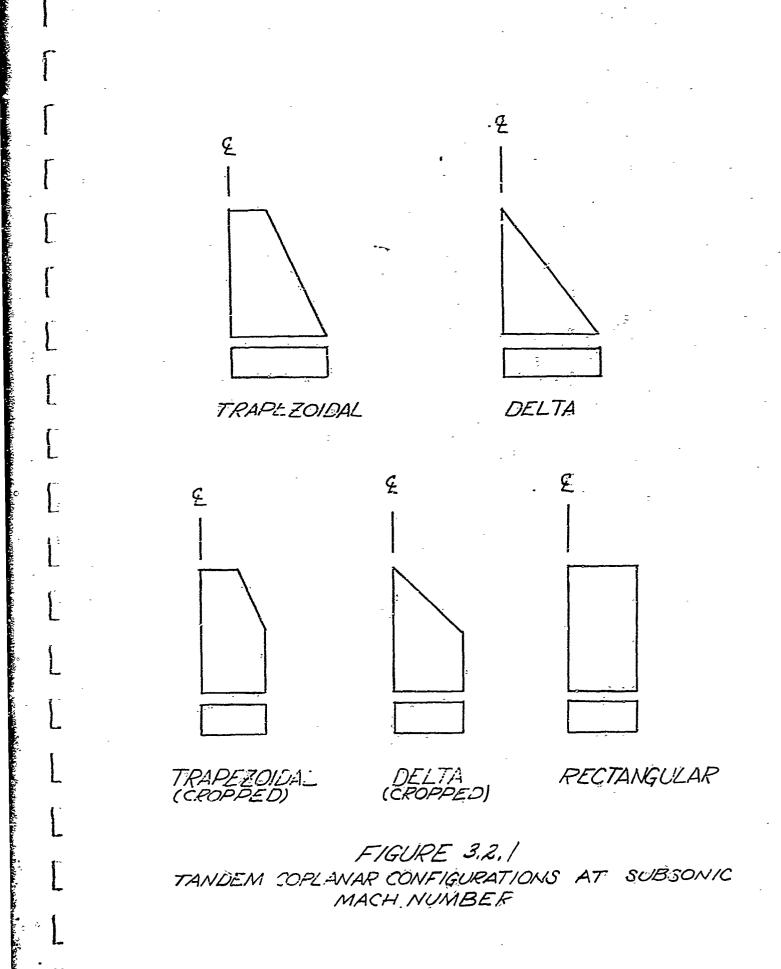


TABLE 3.2.2 - OPTIONAL CONFIGURATIONS

N

Configuration	Chordwise Coordinates	Spanwise Coordinates
Rectangular	X(1) = 0.0 $X(2) = 0.0$ $X(3) > 0.0$ $X(4) > X(3)$ $X(5) > X(4)$	Y(1) = 0.0 Y(2) = 0.0 Y(3) > 0.0
Delta	X(1) = 0.0 X(2) > 0.0 X(3) = X(2) X(4) > X(3) X(5) > X(4)	Y(1) = 0.0 Y(2) = 0.0 Y(3) > 0.0
Trapezoidal	X(1) = 0.0 $X(2) > 0.0$ $X(3) = X(2)$ $X(4) > X(3)$ $X(5) > X(4)$	Y(1) = 0.0 Y(2) > 0.0 Y(3) > Y(2)
Trapezoidal (Cropped)	X(1) = 0.0 X(2) > X(1) X(3) > X(2) X(4) > X(3) X(5) > X(4)	Y(1) = 0.0 Y(2) > 0.0 Y(3) > Y(2)
Delta (Cropped)	X(1) = 0.0 X(2) > 0.0 X(3) > X(2) X(4) > X(3) X(5) > X(4)	Y(1) = 0.0 Y(2) = 0.0 Y(3) > Y(2)

### 3.3 INPUT INSTRUCTIONS

Instructions for preparing input data for the subsonic computer program are presented here. The field location and format for each input quantity is specified. Any set of units may be used for geometric dimensions and acoustic velocity as long as they are consistent e.g., if feet is used for length them the acoustic velocity must have dimensions of feet per second.

### 1. Streamwise Coordinates (6E12.5 format)

Column	1-12	13-24	25-36.	37~48	49-60	61-72
Name	X(1)	X(2)_	X(3)	X(4)	X(5)	
Item	.(1)	(2)	(3)	(4)	<b>(5)</b>	

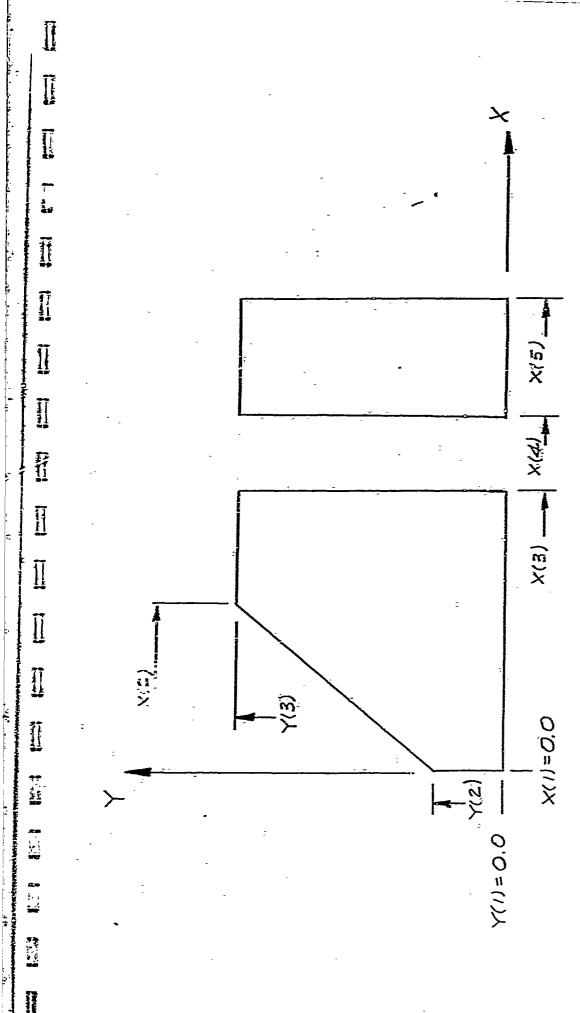
- (1) X(1) Wing root leading edge streamwise coordinate (See Figure 3.3.1)
- (2) X(2) Wing tip leading edge streamwise coordinate
- (3) X(3) Wing trailing edge streamwise coordinate
- (4) X(4) Control surface leading edge streamise coordinate
- (5) X(5) Control surface trailing edge streamise coordinate

The technique for generating various configurations is shown in Table 3.2.1 The origin for the planform and AIC station coordinates must be at the leading edge root of the wing therefore X(1) and Y(1), described below, must always be 0.0.

### 2. Spanwise Coordinates and Acoustic Velocity (6E12.5 format)

Column	1-12	13-24	25-36	37-48	49-60	61-72
Name	Ÿ(1)	Y(2)	Y(3)	SOUND	RHO	-
Item-	.(1)	(2).	(3)	(4)	(5)	

- (1) Y(1) Wing root spanwise coordinate
- (2) Y(2) Wing leading edge spanwise coordinate
- (3) Y(3) Wing (and control surface) tip spanwise coordinate
- (4) SOUND Acoustic velocity for altitude at which analysis is performed
- (5) RHO density of fluid  $\approx 1000.0 \ (M/L^3)$



FIGURET 3.3.1 GEOMETRY DESCRIPTION

### General Information (6112 format)

Column	1-12	13-24	25-35	37-48	49-60	61-72
Name	, XMACH	HFREQ	neaddes	LCØLL	LPRWSH	LPRC
Iten	(1)	(2)	(3)	(4)	(5)	.(6)

- NYACH Number of Mach numbers (max 6) (1)
- Number of frequencies at each Mach number (max 10) NFREQ
- (3) nnodes Number of deformation modes (max 10)
- (4) LCOLL Print collocation stations; 1 ~ Yes; 0 ~ No
- LPRWSH Print pressures and down ashes; 1 ~ Yes; 0 ~ No (5)
- Print pressure coefficients; 1 ~ Yes; 0 ~ No LPRCØ **(6)**

### General Information (6112 format)

Colu≡n	1-12	13-24	25-36	37-48	49-50	61-72
Name	- NWCX	NWPX	NCCX	NCPX	niencx	
Item	(1)	(2)	(3)	(4)	(5)	(6)

- (1) NWCX Number of chord collocation stations - wing(max 10)
- (2) XWPX Number of chord pressure series terms - wing(max 10)
- (3) XCCX Number of chord collocation stations - control surface(max 10)
- Number of chord pressure series terms control surface(max 10) (4) KCPX
- NIØNCX Choose a value of NIGNCX such that NIGNCE \*(NIKCX or NOCA) (5) equals the number of chordwise integration stations

### General Information (6112 format)

Column	1-12	13-24	25-36	37-48	49-60	61-72
Name	YIY	NWCY	NPY	INWIS	isqlat	
Item	(1)	(2)	(3)	(4)	(5)	(6)

- Number of spanwise integration stations (max 11) (1) NIY
- Number of spanwise collocation stations wing (max 11) (2) NWCY
- (3) NPY Number of spanwise pressure series terms (max 10)
- (4) INWTS Read downwash error weighting factors; 1~ Yes; 0~ No
- ISØLAT Isolate wing and control surface; 1~Yes; 0~ No

### Weighting Factors (6E12.5 format) (omit these cards when INWIS = 0)

Column	1-12	13-24	25-36	37-48	49-60	61-72
Name	WT(1)	WT(2)	WI(3)	WI(4)	WI(5)	WE(6)
Item	(1)	.(2).	(3)	(4)	(5)	<b>(6)</b> :

Continue on successive cards until WT(i) = WT(NWTS) Where NWTS = NWCY \* NWCX + NIY \* NCCX

### 7. NOMIT (6112 format) (omit these cards when NWCY = NIY)

Column	1-12	13-24	25-36	37-48	49-60	61-72
Name	KOH(1)	หฮห(2)	neh(3)	NØM(4)	NØM(5)	<b>ห</b> ฮพ(6)
Iten	(1)	(2)	(3)	(4)	(5)	(6)

Continue on successive cards until NOM(2) = NOM(NOMIT) where NOMIT \* NIY-NWCY. For the solution to be carried out, NWCY must equal NIY. When an excessive number of collocation stations exist, they must be eliminated by spanwise rows NOM(1) is the spanwise row number to be eliminated. NOMIT = NIY-NWCY is the number of spanwise rows to be eliminated.

### 8. Mach Numbers (6E12.5 format)

Column	1-12	13-24	25-36	37-48	49-60	61-72
Name	FMACH(1)	FMACH(2)	FMACH(3).	FMACH(4)	FMACH(5)	FMACH(6)
Itea	(1)	(2)	(3)	(4)	(5)	(6)

(1) FMACH(1)

Mach number

(2) FMACH(2)

Mach number

### (NYACH) FMACH(NMACH) Mach number

RMACH values of Mach number must be input. Mach numbers must be greater than zero and less than 0.95.

### 9. Frequencies (6E12.5 format)

Column	1-12	13-24	25-36	37-48	49-60	61-72
Name	FREQ(1)	FREQ(2)	FREQ(3)	FREQ(4)	FREQ(5)	FREQ(6)
Item	(1)	(2)	(3)	(4)	(5)	(6)

(1) FREQ(1)

f(cps)

(2) FREQ(2)

f(čps)

(NFREQ) FREQ(NFREQ)

For NFREQ 6, continue input on new card.

Repeat the following cards i = 1, . . . NMODES

10. Number of Deformation Mode Polynomial Coefficients to be Read for the ith Mode First Surface

	Format(	6112)
Column	1-12	13-24
Name	NZCØ(1,i)	
Item	(1)	(2)

(1) NZCØ(1,i) Number of polynomial coefficients to be read for the first surface, the ith mode.

	Format	(6E12.5)				
Column	1-12	13-24	25-36	37-48	49-60	61-72
Name	CØ(0,0)	CØ(1,0)	CØ(0,1)	CØ(2,0)	CØ(1,1)	CØ(0,2)
Item	(1)	<u>(2)</u>	- .₃ <b>(3)</b>	(4)	(5) .	(6)

CØ(i,j) Deformation polynomial coefficients for the first surface in the order: 0,0; 1,0; 0,1; 2,0; 1,1; 2,0; etc. where the first integer is the power of "x" and the second is the power of "y"

	Format(	5I12)
Column	1-12	13-24
Name	NZCØ(2,i)	
Item	_(1)	(2)

(1) NZC $\emptyset(z,i)$  Number of polynomial coefficients to be read for the second surface and the  $i\frac{th}{t}$  mode.

Column	1-12	. 13-24	25-36	37-48	49-60	61-72
Name	CØ(0,0)	CØ(1,0)	CØ(0,1)	CØ(2,0)	CØ(1',1)	CØ(0,2)
Item	_(1)	(2)	(3)	(4)	(5)	(6)

CØ(i,j) Deformation polynomial coefficients for the second surface in the order: 0,0; 1,0; 0,1; 2,0; 1,1; 2,0; etc.; where the first integer is the power of "x" and the second is the power of "y"

### 3.4 SAMPLE PROBLEM

The generalized forces are calculated for the configuration below. The flight parameters and pertinent input data are presented on the first page of the computer print out.

The coefficients of the deformation modes for the forward suface are shown on the second page of the computer print out, and for the aft surface on the third page of the computer print out.

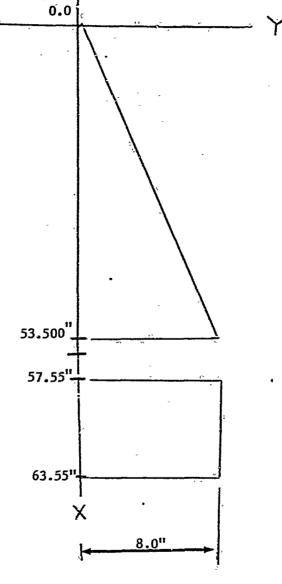


Figure 3.4.1

## HACZNAA MISSILE SUBSONYG AIRLOADS PROGRAM

### FLIGHT CONDITIONS AND GEOMETRY

RH0=0.1146,0000E-06	TAIL	57.550	0.00.0	000 ₹	000 • A	. 000.9	000.96	, SG	•	20.	10	*
SPEED OF SOUND = 13392.000 L/7	HING	• 0	63 , 500	0°•	8.000	• 0	428.000	<b>, LS</b> 1	æ.	25	Į.	
MACH NUMBER = 11.75000 SPE	-	L.E. STATION (L)	ROOT CHURD (L)	L.E. SPAN (L)	T.E. SPAN (L)	TIP CHORD (L)	TOTAL AREA (L*L)	SPAN COLL. STA.	CHORD COLL. STA.	CHORD INTO. STAG	SPAN PRES MODES	CHORD PRES HODES

T

Trail.

Townson of the last of the las

S. September 5

7

## MISSILE SUBSONIC ATRECAUS PROGRAM (CONTID)

TAPUT MODE SHAPE POLYNOPIAL CUEFFICIENTS FOR HING

# REFFRENCED IN THE SURFACE LEADING ENGE-CENTERLINE INTERSECTION

Mone		COEFFS.		-	-		
<del></del>	2.6521F-04 3.4901F-04 1.7143F-03	-5.13696-03 -1.82806-02 -8.72036-09	11.72976:01 4.43156:02 3.44486:02	6.64108±04 1.92698±06 -7.6417±06	1.2377E-02 -2.7631E-05 3.2771E-05	7.0302E-02 -4.0302E-04	12.486E108
۸.	-2.1230E-02 1.1767E-02 1.2788E-02	6.6160E-03 -6.1689E-02 -3.8299E-08	5.4738E-01 2.1984E-01 3.5697E-06	8.5723E-04 3.9306E-06 -3.7881E-05	-1.2727E-01. -3.6816E-04	030	1355E=0 4335E=0 9772E=0
rs	-8.4265E-03 2.5723E-03 1.3232E-02	1.52266-03 -1.27936-01 -7.08876-08	3.4273E-01 3.0849E-05	2.248861103 7.65016103 688861106	1.22966101 2.45796101 2.48166104	200 200 200 200 200 200 200 200 200 200	.4958E.0 .9536E.0 .4070E.0
4	-2.3616E-03 7.3151E-04 -9."423E-03	-9.5620E-03 -5.9538E-02 -0.8432E-09	-1.2947E-01 2.1428E-01 6.9796E-07	8.80898-04 1.17718-06 -1.95368-05	2.8617E-02 -5.9277E-05 4.5021E-05	.8725e- .15176-	45 53 53 51 50 50 50 50 50 50 50 50 50 50 50 50 50
S.	-1.8034E-04 1.5355E-04 2.6742E-04	-1.8284E=U5 3.0570E=04 1.1484E=10	1.3879E-02 -9.9055E-04 3,0569E-08	11.0982E=05 11.6682E=05 11.4258E=07	-2.9642E-03 -3.5623E-06 2.1170E-06	• • •	₩ ₩ ₩

## MISSILE SUBSONIC AIRLUADS PROGRAM (CONT'D)

THE PROPERTY OF THE PROPERTY O

5 DEFLECTION MODES	FREE STREAM MACH NUMBER
475% 00000	ENGY (SEMI CHORD) 2.92843
E GENERA (GPS.)	CHORD
) XUN	(SEM)
LATURY FREGUE	PREQUE
08611	REDUCED

# 14PUT MODE SHAPE POLYNOPIAL CUEFFICIENTS FOR TAIL

# REFIRENCEW TO THE SURFACE LEADING EDGE-CENTERLINE INTERSECTION

	-4.2571E-04 -5.2663E-05	1.7459E-03 3.5729E-06	-2.9670E-04 -3.5626E-05	-1.7439E-02 -1.6472E-06	9.3476E-03
	-1.3471E-02 1.1246E-06	-1.3226E-03 8.0306E-05	8.7454E+05 3.0552E+05	1.8561E-02 1.5943E-04	34.9283E-03
-	-1.5111E-03 4.6416E-05	1.1958E-03 4.2814E-05	-1.5586E-03 -2.3779E-05	3.2691E-02. 7.1000E-04	1.2655E-02
,	9.07026-04 3.94996-05	-5.7007E-03 -1.5632E-04	3.8815E=04 3.4503E-05	9.4683E-02 1.0735E-03	-4.3907E=02
,	-2.01096-02 -1.6279E-03	-5.0481E-03 2.8156E-04	7.1003E-03 2.5398E-04	-3.9674E-02 -2.6337E-05	-1.2775E-02
COEFFS.	1.3407E-028.888247E-04	1.3622E=02 ?.4416E-05	1,1602E-02 1,9642E-04	-2.2355E±01 -1:4563E-03	3.12618-01
	-2.5045E-01, -5.1564E-04 2.4874E-04	-6.02 -4.4974E-04 -2.5385E-05	-1.6215E=02 4.9260E=05 -2.7265E=05	1.3420E-01 -8.4577E-03 -1.3343E-04	-6.4398E=01
MODE	-	<b>≈</b>	io.	18	ĺυ

## I Samples S Total State

HISSILE SUBSONIC AIRLUANS PROURAM (CONT'D)

	20	0ENERAL REAL PART 1.78433E 00. -4.1957ic 00 9.34031E-01 1.03725E 01 -5.40024E-62 -7.6724HE 00 1.58403E 01 -2.68136E 03	RT 1HAG PART  OU1.203756-U1  OU1.203756-U1  OU -1.270986 D1  OU 6.674756 U0  -6.2673106 U0  OU -2.673106 U0  OU -2.673106 U0  OU -3.940866 O1	AHS VALUE  2.786396 00  4.625806 00  1.234416 01  1.23456 01  6.421676-01  1.094556 01  4.758296 01  4.758296 01	PHASE ANGLE -3.859 DEC 155.097 DEC -85.797 BEC 32.762 DEU 94.824 DEU
-	2	1.78433E 004.1957E 00 9.34031E-01 1.03/25E 01 -5.40024E-62 -7.6724HE 00 1.58403E 01 -2.68136E 01	1.947,64% UD -1.20375E-U1 1.947,64% UD -1.27098% D1 6.67475% UD 6.39892%-U1 -2.67310% UD -6.01938% UD	AMS VALUE  1.786396 00  1.625806 00  1.23.456 01  0.421676-01  0.424806 00  1.694596 01  4.756296 01	2
ете те е е од (д. c	— 0 b 4 v + c b 4 v	1.78433E 004.1957E 00 9.34031E-01 1.03725E 01 -5.40024E-62 -7.67248E 00 1.58403E 01 -2.68136E 01	-1.20375E-01 1.94784E 00 -1.27098E 01 6.67475E 00 6.39892E-01 -2.67310E 00 -6.01938E 00	1.786396 00 4.625806 00 1.233456 01 0.421676-01 8.124806 00 1.694556 01 4.758296 01	
	0 12 4 12 4 6 13 4 12	-4,1957% = 00 9,34031E-01 1,03725E 01 -5,40024E-62 -7,67248E 00 1,58403E 01 -2,68136E 01	1.947,646 00 -1.270986 01 6.674,756 00 6.398926-01 -2.673106 00 -6.019386 00	4.62580E 60 1.23345E 01 0.42167E-01 8.12480E 00 1.69455E 01 4.75829E 01	
क्रम का 104 gal s	10 4 n 4 v 10 4 n	9.34031E-01 1.03/25E 01 -5.40024E-62 -7.67248E 00 1.58403E 01 -2.68136E 03	-1.27098E 01 6.67475E 00 6.39892E-01 -2.67310E 00 -6.01938E 00 3.94086E 01	1.23345E 01 1.23345E 01 0.42167E-01: 8.13480E 00 1.69455E 01 4.75829E 01	
ਜ ਜ 'Ou gu c	. 4 m 4 v 15 4 m	1.03/25E 01 -5.40024E-62 -7.6724HE 00 1.58403E 01 -2.68136E 01 -2.46347E 01	6.39892E-U1 -2.67310E U0 -6.U1938E U0 3.94086E 01	1.23345E U1 0.42167E-U1: 0.1248UE OU 1.69455E U1 4.75829E U1 4.45103E OI	
en jon èn s	w	-5.40024E-62 -7.6724BE 00 1.78403E 01 -2.68136E 01 -2.46347E 01	6.39892E-U1 -2.67310E U0 -6.U1938E U0 3.94086E 01	0.42167E-U1. 0.1248UE 00 1.69455E 01 4.75829E 01 4.45103E 01	
,≤n èn s	ч <i>v</i> ъ̀ <b>4</b> гv	-7.6724HE 00 1.78403E 01 -2.68136E 01 -2.46347E 01	-2.67310k u0 -6.01938E u0 3.94086k 01	8.12480E 00 1.69455E 01 4.75829E 01 4.45103E 01	
èn s	ν ώ 4 π.				
•	න් 4 <i>ක</i>				-204807 UEU
v	4 W			4.45103E 01	124,299 DEG
∾.	r,		-3.70716E U1		-123.605 DEU
~		00 31620630	-9.48398E UO	1.27373E .01	-48.123 DEG
က်	<del>-</del>	4.08041E no	2.08661E uj.	2.12633E 01	78.936 BEG
:rs	٥.	1.35203E 01	-2.18268E 01	2.5673UE 01	-58.225, DEG
rs	n	1.990158 02	-7.145U7E UO	1.99145E '02	-2.056 DEb
ю	Ť	-9.86493E 01	1.51302E 02	1.80621E 02	123.104 DEG
'n	r.	-2.47112E 01	3.74608E 01	4.48771E UL	123.411 DEG
₹		.6.U4736E On	-1.57318E U1	1.68541E 01	+68.973 DEU
•	82	-3.81092E.01	2.17331E 01	4.38699E 01	150.304 BEG
•	rs	-1.444316 02	-7.27240E 01.	1.61707E 02	-153.274 DEU
•	•	1.365565 02	-6.84736E 01	1.52762E 02	-26.631 DEG
₹.	ro.	1.99313E 01	-3.09072E 01	3.67765E 01	-57.163 DEG
ĸ	~	-10.62374E-01	-9.08/986-02	1.86u62E-01	-350.773 DEG
'n	<b>~</b> ;	2.190446-03	2.215538-01	3.11954E-01	45.326 DEG
ΣΛ.	, D	-9.00154E-01	1.649986 00	1.87955 00	118.615 DEU
åì	Ţ	-6.57931E-01	-1.45552E 00	1.781476 .00	-111.674 DEG
v	īv.	1,, 484016-03	-2.23596k-01	2.2360%E-01	99° 620° 0EG

### HISSILE SUBSONIC ATHLUAUS PROUKAN (COLT'D)

-54.470 DEU 164.470 DEU 164.050 DEU 39,282.0EU	PHASE ANULE 164.470 DEU 164.050 DEU 39,282 DEU 174.657 HEU 20.536 DEU -75.390 DEU	HASE ANULE 54.470 DEU 63.050 DEU 74.657 DEU 76.536 DEU 76.300 DEO 60.260 DEO 70.060 DEO 70.060 DEO 70.060 DEO	E ANGLE 170 DEU 170 DEU 170 DEU 170 DEU 170 DEU 175 DEU	
39,282	-54.470 39,282 37.687 20.530 -74.390 3160.260	-54.470 DEU 39.050 DEU 39.282 DEU 20.536 DEU -77.390 DEO 55.015 DEO -170.063 DEU -19.168 DEU -163.384 DEU	103.050 103.050 174.057 20.530 174.050 170.060 170.060 170.060 170.060 170.060 170.060 170.060 170.060 170.060 170.060 170.060 170.060 170.060	104.470 104.050 174.050 174.050 174.050 195.000 195
	₩	<del>*</del>	•	*
2.76u19E 1.43392E	2.76419E 1.1800UE 1.0435/E 4.05134E 5,50883E	2.76419E 1.43392E 1.1800UE 1.04357E 3.50683E 1.5149E 1.55449E 1.77443E	2.76ulyE 1.43392E 1.1600UE 1.0435/E 4.U5134E 3,50083E 1.52049E 1.52049E 1.95755E 7.0966UE 7.79125E 1.79125E 1.79125E	2.76419E 1.18060E 1.182097E 1.95358E 1.70746E 1.95358E 2.95466UE 7.0966UE 8.45928E 4.84259E
	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0			
0.3/68/0.6		1.14296 11 4.66232 11 4.66232 11 1.149878 01 1.498478 01 1.498668 00 -2.946568 00 -2.946568 00 -2.946568 00 -2.946568 00	1.1429t 111 4.66232t 111 1.1429t 111 1.14281t 00 1.14286t 00 1.669312t-01 1.669312t-01 1.699428t 00 1.699428t 00 3.61667t-01	1.10429E U 1.10429E U 1.10429E U 1.10531L U 1.49847E U 1.49847E U 1.49847E U 1.49847E U 1.49842E U 1.5088E
	4 4 6 m 4.	4 4 5 4 4 5 6 7 4 4 5 6 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	4 4 5 4 5 6 5 5 5 5 5 5 5 5 5 5 5 5 5 5	4 4 5 4 4 5 4 4 5 5 5 6 4 5 6 6 6 6 6 6
¥ •		•	*	
1. 53634E	1.08962E -3.30264E 1.04867E	1.089626 -3.30264E 1.04467E -1.60185E 1.51049E -1.75394E 1.67228E	1.089626 -3.302646 -1.601856 -1.753946 -1.753946 -3.341956 -7.041056 -7.041056	1.089626 00 1.048676 01 1.048676 01 1.010496 01 1.072286 00 5.045356 00 -1.340956 00 -1.041056 00 -1.045056 01 -1.045056 01 -1.045056 01
יט יו	- ~ 5	- 4 5 4 4 4 5	- ~ 5 4 7 4 7 5 4 7	- 0 2 4 6 4 6 4 6 4 6 4 6 4 6 4 6 4 6 4 6 4

### O chanta Cornel Riman STATE OF B HERMAN 1 Topology ( I Married Street T

### HISSILE SUBSONIC ATRICAOS PROURAR (CONTID.)

Į.	UCFI FREDU	HFDUCFD FREQUENCY (SENI CHORD)	2.92843	FREL STREAM MACH NUMBER	UMBER U.75U
		GENERA	<b>UENERALIZEŲ FONCES FOR W</b>	HING + TAPL	
ารลูเ	LOAP	REAL PART	IBAG PART	AHS VALUE	PHASE AHOLE
<u>.</u>	ū	1.462588 01	-2.37847E UT	3.01468E 01	-81.842 088
,	æ	-4.05986E 01	9.99479E 00	3.21896E 111	161.911.460
	B <sub>1</sub>	1.119256 02	7.807591 01"	1.36467E 02	34.099 DEG
	▼ .	-1.47712E 02	f.77176E 01	1.091606 020	170.659.DEU
-	ĸ	9.53194E 01	4.726316 -01	1.045978 02	26.863 1165
ð.	₩,	-4.582866 00	-K.57516E 00	9.3442E.00	-135.034 DEG
۸.	ζ	1.25,1776 01	-4.63428E 40	1,343746 01	-21.546 DEU
~	PS	-1.63268E 01	5.42933E 01	5,66951E 01	106,737 DEU
~	•	44.14532E 01	-4.001'B1E.01'	10 38718cd.	-136.069 DEU
N	ĸ.	2.46 U74E 01	-9.49866E 30	2.54467E 01	-21.918 DEG
ю		2:32647E 00	2-173748 01	2.18616E 01	83.801 BEG
ы	Ču	1.519268 01	-2.24881E 01	2.70728E 01	-85.863 DEU
ю	n	1.89483E 02	.9,94943£ 00	1.89747E 02	-3.018 DEG
m	4	-9.28040E 01	1.472761 02	1.740786 02	122.216 DEU
ب ا	9	-2.80521E 01	3.046656 (8).	4.141d1E D1	132.637 DEU
•	-	-9.93673E-61	~5.64895E us	5.92487E 00	#99%655 DEG
÷	~	-2.96567E 01	2.20948E 01	3.69824E 01	143.513 DEG
•	ю	-1:93768E 02	-1.82126E 02	2.19081E 02	-152.211 DEG
•	•	1.843318 02	-0.01525E 01	2.01084E 02	~23.501 µEU
<b>4</b>	RU.	-2.50541E 01	-4.88318E.01	5.488405 01	-117.161 NEG
ro.	#4	-1.001398 01	-3.43042E 01	· 5.57359E U1	-106,273 DEC
r.	∾	-8.7836ng oo	-2.31966E 00	9.08479E 0u	-165.205 DEG
ស	ស័	1.07453E n1	\$.83820E u1	9.69670€ 01	93.767 DEW
· k	4	-1.01480E 02	-5,47397H 01	1.153008 02	-151.657 DEG
s	z.	1.421,678.02	-9.60747E 01	1.715866 02	-34.050 DEC

### 3.5 PROGRAM LISTING

```
UPIION FORTRAN
                                                                             SU273828
       FORTRAN HLSTOU, DECK
                                                                             SU278328
       INCODE
                IBKF
                                                                             SUL7#338
CHAIN.
                                                                             SUE##348
             MAIN
      COMPLEX ASAA,ANM,CZERU,GFURG,DELP,WASHSAPR,DWASHSUNASH,PR
                                                                             SUB7#350
      DIMENSION DWASH(90,18), PR(90,18), CWASH(98:18)
                                                                             SUBTESAS
      DIMENSION GFORC(10,10,3), DELP(10), WASH(10)
                                                                             SUB7#37#
      COMMON/C1/A(60),AA(50,60),ANN(5%,18),CZERO
      COMMON/CZ/CLEN, SN/NIY, NWCX, NCCX, NWPX, NCPX; NKER(28); ZKER(28); NCSKRNSUB70398
      COMMON/C3/NPY-SOUND; MHACH, FHACH(6), MFREG; FREQ(18); MAUG, MIONCX, RHG SUB78488
      COMMON/C4/NHODES, LCOLL, LPRWSH, LPRCO, NON(5), IIY, IIX, NSURF, ISOLAT
                                                                             SUB7#41#
      COMMON/C5/FH, FC, RCOES, NOMIT, ALPHA(18), IL(58), HCOR(6), ZCOR(6), HACH SUB78428
      COMMON/C6/HXCHN(11), HBCN(11), HB1N(11), HT(98), XGOLL, YCOLL, PI, U
                                                                             SUB7.8438
      COHHON/C7/C0(10,28/2),NZC0(18,2),EH;EK;B2,NVIX,NCIX,NBO,CDOM,NHCY SDB7844W
      CUMMON/CB/IFR, XE(5), YE(3), UX(10), UY(10), WXIMM(11), E1, E2
                                                                             $UB73458
      CUMMON/C9/S1x(40>2),SCX(18,2),Y(11)>ETA(11),QNY,QNHX,QNCX,CXHN
                                                                             SUB78468
      COMMON/CPR/APR(90,60), INOB, IROW
                                                                             SUB78478
      EUUIVALENCE (GFORC:AA),(A,WASH),(WASH,DELP)
                                                                             SUB78488
      EUULYALENCE (DWASH(1,1), APR(1,51)), (PR(1,1), APR(1,11))
                                                                             SUB78498
      EQUIVALENCE (CHASH(1,1), APR(1,41))
                                                                             SUB78588
      WHITE (6,66)
                                                                             S9878519
   66 FORMAT(1H1)
                                                                             SUB7.6528
    1 CAEL KEDA
                                                                             SUB78538
      F_{\lambda} = 2*NWIX + 1
                                                                             SUB/8548
      FG = 2*NCIX + 1
                                                                             SUB78550
      QWHX = 2.0*PIPEH
                                                                             SUB78562
      QHCX = 2.0*PI/FC
                                                                             SUB78578
      QWY = PI/FLUAT(2*NIÝ)
                                                                             SUB78580
      CALL GEON
                                                                             SU371591
      DO 100 MACH=1. NHACH
                                                                             SUB78698
      MACH = MACH
                                                                             SUB7#61#
      EN = FHACH(MACH)
                                                                             SUB77628
      CALL KOUT(1)
                                                                             SUB78638-
      U = EM+SOUND
                                                                             SUB78649
      IF (LCOLL.NE.B) CALL KOUT (2)
                                                                             SU878658:.
      BOU = MBO\U:
                                                                             SUB78668
      82 = 1.0 - EM*EM:
                                                                             SUB70678.
      TO 100 JFR=1,NFREG
                                                                             SUB75688
      IFR = TFR
                                                                             SUB79698
      EK = 2.0*PI*FREQ(IFR)*BOU
                                                                             SUB78788
      NSURF = 1 (HING) OR 2 (CONTROL)
                                                                             SUB78718
      NCX = NHCX
                                                                             SUB78728
      MORIT = T
                                                                             SUB78739
      MAÚĜ = NÇOLS + NHODEŠ
                                                                             SUB787.48
      DO 4 J=1 NCOES
                                                                             SU879758
      IL(J) = 0
                                                                             SUB? #769
      BU 4 K=1, MAUG
                                                                             SUB79770
      AA(J,K) = CZERO
                                                                             SUE70780
      IRON = 1
                                                                             SUB70790
      DU 15 NSURF=1,2
                                                                             SU979800
      NSURF = NSURF
                                                                             SUB70810
      CALL KOUT (6)
                                                                             SUB70820
      KOUT (6) PRINTS COEFFICIENTS OF DEFLECTION SERIES
                                                                             SUB70839
      DO 14 IY=1,NY
                                                                             SUB70840
      IIY = IY
                                                                             SUB70850
      IF (NOMIT-MOMIT.LT.O) GO TO 7
                                                                             SUB70860
      IF(IY-NOM(MUHIT).EQ.O) GO TO 13
                                                                             SUB70870
         YCOLL = SN#Y(IY)
                                                                             SUB70869
        DU 12 IX=1,NCX
                                                                             SUB70890
      IIX = IX
                                                                             SUB70900
                                        22
```

1	<del>-</del>	•
	XCOLL = XS(1, NSURF, IX, IY)	SUB7.8910
		SU870920
<b>T</b>	CALL CORB	
Įε	*** CORD FILLS OUT A ROW OF THE DOWNWASH HATRIX EACH TIME CALLED	
	DO 58 N = 1.NHODES	SUB70940
	CALL ZBZX(K,SLOPE,DEFL)	SUB70951
1	HNC = NCOLS +H	SUB78968
1	50 WASH(HNC) = CHPLX(SLOPE, DEFL+EK/MBO)	SUB70970
<del>-</del>		
	DO 40 K=1, HAUG	SUB70980
<b>I</b>	XI = X	SUB70990
	IF(X.GT.NCOLS) K1 = 58 + K → NCOLS	SUB71000
-	48 APR(IRON, K1) = A(K)	SUB71810
	DO 68 N=1, NCOLS	SUB71020:
		SU871030
. Ł	68 CALL CGRED(A, MoN)	
	DO 78 E=1, NHODES	SUB/1040
	ML = MCOLS + L	SUB71050
H	75 ALPHA(L) = SQRT(ALPHA(L)**2 + CABS(A(ML))**2)	SUB71060
<u> </u>	TRON = 1RON + 1	SUB71070
_	12 CONTINUE	SUB71089
	GU TC 14	SÛ87109Ô
1	13 NOMIT = NUMIT +1	SUB71100
		SUB/1110
	14 CUNTINUE	
	AGX = ACCX	SUB/1120
1	15 CONTINUE	SUB71130
Ī	CALL XLSO	SUB71140
C	*******************************	*#SU871158
_	IF(EPRCO-EQ.65 GO TO 17	SUB71160
Ũ c		
₩C		
: -	DO 16 INOD=14HYDES	SUB71180
	INOD = INUD	SUB71190
1	16 CALL KOUT(3)	SUB71200
II c	KOUT(3) PRINTS COEFFICIENTS OF PRESSURE SERIES FOR EACH HODE	SU871210
ε	*************************	
		##SUU71220
•		
•	17 IF(EPRNSH.EU.") 60 TO 69	SUB71230
II c	17 IF (EPRNSH.EU.#) GO TO 69	SUB71230 **SUB71240
•	17 IF (EPRNSH.EU.u) GO TO 69 ************************************	SUB71230 **SUB71240 SUB71250
II c	17 IF (EPRNSH.EU. 4) GO TO 69 ************************************	SUB71230 **SUB71240 SUB71250 SUB71260
	17 IF (EPRNSH.EU.u) GO TO 69 ************************************	\$UB71230 **\$UB71240 \$UB71250 \$UB71260 \$UB71270
	17 IF (EPRNSH.EU. 4) GO TO 69 ************************************	SUB71230 **SUB71240 SUB71250 SUB71260 SUB71278 SUB71280
	17 IF (EPRNSH.EU.u) GO TO 69  ***********************************	\$UB71230 **\$UB71240 \$UB71250 \$UB71260 \$UB71270
	17 IF (EPRNSH.EU.u) GO TO 69  ***********************************	\$U871230 **\$U871240 \$U871250 \$U871260 \$U871270 \$U871280 \$U871290
	17 IF (EPRNSH.EU.u) GO TO 69  ***********************************	SUB71230 **SUB71240 SUB71250 SUB71260 SUB71270 SUB71280 SUB71290 SUB71300
	17 IF (EPRNSH.EU.u) GO TO 69  ***********************************	SUB71230 **SUB71240 SUB71250 SUB71260 SUB71270 SUB71280 SUB71290 SUB71300 SUB71310
	17 IF (EPRNSH.EU.u) GO TO 69 ************************************	SUB71230 **SUB71240 SUB71250 SUB71260 SUB71270 SUB71280 SUB71290 SUB71300 SUB71310 SUB71320
	17 IF (EPRNSH.EU.u) GO TO 69 ************************************	SUB71230 **SUB71240 SUB71250 SUB71260 SUB71270 SUB71280 SUB71290 SUB71300 SUB71310 SUB71320 SUB71330
	17 IF (EPRNSH.EU.u) GO TO 69  ***********************************	SUB71230 **SUB71240 SUB71250 SUB71260 SUB71270 SUB71280 SUB71290 SUB71300 SUB71310 SUB71320 SUB71330 SUB71330 SUB71330
	17 IF (EPRNSH.EU.u) GO TO 69 ************************************	SUB71230 **SUB71240 SUB71250 SUB71260 SUB71270 SUB71280 SUB71280 SUB71310 SUB71310 SUB71320 SUB71330 SUB71330 SUB71330 SUB71350
	17 IF (EPRNSH.EU.u) GO TO 69  ***********************************	SUB71230 **SUB71240 SUB71250 SUB71260 SUB71270 SUB71280 SUB71290 SUB71310 SUB71310 SUB71320 SUB71330 SUB71330 SUB71330 SUB71330 SUB71350 SUB71360
	17 IF (EPRNSH.EU.II) GO TO 69  ***********************************	SUB71230 **SUB71240 SUB71250 SUB71260 SUB71270 SUB71280 SUB71290 SUB71310 SUB71310 SUB71320 SUB71330 SUB71330 SUB71330 SUB71350
	17 IF (EPRUSH.EU. M) GO TO 69  ***********************************	SUB71230 **SUB71240 SUB71250 SUB71260 SUB71270 SUB71280 SUB71290 SUB71310 SUB71320 SUB71330 SUB71330 SUB71330 SUB71360 SUB71360 SUB71370
	17 IF (EPRNSH.EU.N) GO TO 69  ***********************************	SUB71230 **SUB71240 SUB71250 SUB71260 SUB71270 SUB71280 SUB71290 SUB71300 SUB71310 SUB71330 SUB71330 SUB71330 SUB71330 SUB71350 SUB71360 SUB71370 SUB71380
	17 IF (EPRNSH.EU.#) GO TO 69  ***********************************	SUB71230 **SUB71240 SUB71250 SUB71260 SUB71270 SUB71280 SUB71290 SUB71300 SUB71310 SUB71320 SUB71330 SUB71330 SUB71330 SUB71360 SUB71370 SUB71380 SUB71390
	17 IF (EPRUSH.EU.U) GO TO 69  ***********************************	SUB71230 **SUB71240 SUB71250 SUB71260 SUB71270 SUB71280 SUB71280 SUB71300 SUB71310 SUB71320 SUB71330 SUB71330 SUB71330 SUB71350 SUB71360 SUB71370 SUB71380 SUB71390 SUB71390 SUB71400
	17 IF (EPRNSH.EU.N) GO TO 69  ***********************************	\$UB71230 **\$UB71240 \$UB71250 \$UB71260 \$UB71270 \$UB71270 \$UB71280 \$UB71300 \$UB71310 \$UB71320 \$UB71330 \$UB71330 \$UB71350 \$UB71360 \$UB71370 \$UB71380 \$UB71380 \$UB71380 \$UB71380 \$UB71380 \$UB71380 \$UB71380 \$UB71380 \$UB71380 \$UB71380 \$UB71380
	17 IF (EPRUSH.EU.U) GO TO 69  ***********************************	\$UB71230 **\$UB71240 \$UB71250 \$UB71260 \$UB71270 \$UB71280 \$UB71280 \$UB71300 \$UB71310 \$UB71320 \$UB71330 \$UB71330 \$UB71350 \$UB71360
	17 IF (EPRNSH.EU.U) GO TO 69  ***********************************	\$UB71230 **\$UB71240 \$UB71250 \$UB71260 \$UB71270 \$UB71280 \$UB71280 \$UB71300 \$UB71310 \$UB71320 \$UB71330 \$UB71330 \$UB71330 \$UB71350 \$UB71360 \$UB71360 \$UB71390 \$UB71390 \$UB71400 \$UB71410 \$UB71420 \$UB71430
	17 IF (EPRNSH.EQ.N) GO TO 69  COMPUTE AND STORE THE PRESSURE DOWNWASHES  MUMIT = 1  IROW = 1  MCX = MUCX  DO 115 MSURF = 1, 2  DO 114 IY=1, MIY  IF (NOMIT-LT-MOMIT) GO TO 197  IF (IY.EQ.NOM(MOMIT)) GO TO 113  187 DO 112 IX=1, MCX  DO 140 IM=1, MMODES  A(IM) = CZERG  DO 140 JC=1, MCOLS  140 A(IM) = A(IM) + APR(TROW, JC) + ANH(JC, TM)  DO 150 IM=1, MMODES  150 CMASH(IROW, TM) = A(IM)  IROW = IROW +1  112 CONTINUE  GO TO 114  113 MOMIT = MOMIT +1	\$UB71230 **\$UB71240 \$UB71250 \$UB71260 \$UB71270 \$UB71280 \$UB71280 \$UB71300 \$UB71310 \$UB71320 \$UB71330 \$UB71330 \$UB71330 \$UB71350 \$UB71360 \$UB71360 \$UB71390 \$UB71390 \$UB71400 \$UB71410 \$UB71420 \$UB71430
	17 IF (EPRNSH-EQ.N) GO TO 69  ***********************************	\$UB71230 **\$UB71240 \$UB71250 \$UB71260 \$UB71270 \$UB71280 \$UB71280 \$UB71300 \$UB71310 \$UB71320 \$UB71330 \$UB71330 \$UB71330 \$UB71360
	17 IF (EPRNSH.EO.#) GO TO 69  COMPUTE AND STORE THE PRESSURE DOWNWASHES  MUMIT = 1  IROW = 1  MCX = MMCX  DO 115 MSURF = 1, 2  DO 114 IY=1, MIY  IF (NOMIT-LT-MOMIT) GO TO 197  IF (IY.EQ.MOM(MOMIT)) GO TO 113  187 DO 112 IX=1, MCX  DO 140 JC=1, MCOLS  A(IM) = CZERG  DO 140 JC=1, MCOLS  140 A(IM) = A(IM) + APR(TROW, JC) * ANH(JC, IM)  EO 150 IM=1, NMODES  150 CMASH(IROW, IM) = A(IM)  IROW = IROW +1  112 CONTINUE  GO TO 114  113 MOMIT = MOMIT +1  114 CONTINUE  NCX = NCCX	SUB71230 **SUB71240 SUB71250 SUB71260 SUB71270 SUB71280 SUB71280 SUB71320 SUB71320 SUB71320 SUB71330 SUB71330 SUB71360 SUB71360 SUB71360 SUB71360 SUB71360 SUB71360 SUB71360 SUB71360 SUB71360 SUB71360 SUB71360 SUB71360 SUB71400 SUB71410 SUB71420 SUB71430 SUB71440 SUB71440 SUB71440 SUB71450
	17 IF (EPRNSH-EQ.N) GO TO 69  ***********************************	\$UB71230 **\$UB71240 \$UB71250 \$UB71260 \$UB71270 \$UB71280 \$UB71280 \$UB71300 \$UB71310 \$UB71320 \$UB71330 \$UB71330 \$UB71330 \$UB71360 \$UB71360 \$UB71360 \$UB71390 \$UB71410 \$UB71420 \$UB71420 \$UB71440 \$UB71450 \$UB71460
	17 IF (EPRNSH.EQ.N) GO TO 69  ***********************************	\$UB71230 **\$UB71240 \$UB71250 \$UB71260 \$UB71270 \$UB71270 \$UB71280 \$UB71280 \$UB71300 \$UB71310 \$UB71320 \$UB71330 \$UB71330 \$UB71330 \$UB71350 \$UB71360 \$UB71370 \$UB71380 \$UB71390 \$UB71410 \$UB71420 \$UB71420 \$UB71430 \$UB71440 \$UB71470 \$UB71470
	17 IF (EPRNSH.EQ.N) GO TO 69  ***********************************	\$UB71230 **\$UB71240 \$UB71250 \$UB71260 \$UB71270 \$UB71270 \$UB71280 \$UB71300 \$UB71310 \$UB71320 \$UB71330 \$UB71330 \$UB71330 \$UB71350 \$UB71360 \$UB71360 \$UB71380 \$UB71380 \$UB71380 \$UB71400 \$UB71420 \$UB71440 \$UB71440 \$UB71440 \$UB71460 \$UB71470 \$UB71470 \$UB71470 \$UB71470
	17 IF (EPRNSH.EO.W) GO TO 69  ***********************************	\$UB71230 **\$UB71240 \$UB71250 \$UB71260 \$UB71270 \$UB71270 \$UB71280 \$UB71280 \$UB71300 \$UB71310 \$UB71320 \$UB71330 \$UB71330 \$UB71330 \$UB71350 \$UB71360 \$UB71370 \$UB71380 \$UB71390 \$UB71410 \$UB71420 \$UB71420 \$UB71430 \$UB71440 \$UB71470 \$UB71470
	17 IF(EPRNSH.EU.N) GO TO 69  ***********************************	\$UB71230 **\$UB71240 \$UB71250 \$UB71260 \$UB71270 \$UB71270 \$UB71280 \$UB71300 \$UB71310 \$UB71320 \$UB71330 \$UB71330 \$UB71330 \$UB71350 \$UB71350 \$UB71360 \$UB71360 \$UB71360 \$UB71360 \$UB71360 \$UB71360 \$UB71400 \$UB71420 \$UB71440 \$UB71440 \$UB71460 \$UB71470 \$UB71460 \$UB71470 \$UB71480
	17 IF (EPRNSH.EO.W) GO TO 69  ***********************************	\$UB71230 **\$UB71240 \$UB71250 \$UB71260 \$UB71270 \$UB71280 \$UB71280 \$UB71300 \$UB71310 \$UB71320 \$UB71330 \$UB71330 \$UB71330 \$UB71350 \$UB71360 \$UB71360 \$UB71360 \$UB71360 \$UB71400 \$UB71400 \$UB71420 \$UB71450 \$UB71460 \$UB71470 \$UB71480 \$UB71480 \$UB71490

فكالأدعيسي الأشميه فلا

```
IMOD = IMOD
                                                                             SUB71528
      NCX. = NHCX
                                                                             SUB71538
                                                                             SUB71548
      MOMIT = 1
                                                                             SUB71558
      IROW = 1
      nu 99 NSUNF=1,2
                                                                             SUB7156t
                                                                             SUB71578
      NSURF = NSURF
      CALL KOUT (7)
                                                                             SUB71588
      KUUL (7) PRINTS THE HEADER FOR THE PRESSURE AND DOWNWASH ARRAYS
C
   90 00 98 IY=1;NIY
                                                                             SUB71688
      IF (NOMIT-LT-MOMIT) GO TO 91
                                                                             SUB71618
      IF(IY.FO.NOM(MOMIT)) GO TO 97
                                                                             SUB7162E
   91 YUNLL ≠ MHO*SN*Y(IY)
                                                                             SuB7163#
      DU 96 1X=1,NCX
                                                                             SUB7164#
      XCOLL = WBO*XS(1, NSURF, IX, IY)
                                                                             SUB71658
      CALL KOUT(9)
                                                                             SUB71661
      KUUI (9) PRINTS: THE X AND Y COORDINATES OF EACH COLLOCATION
                                                                             SUB7167#
                                                                             SUB71688
·C
      POINT, THE LOCAL PRESSURE, THE DOWNMASH CREATED THERE BY THE
                                                                             SUB7169#
      PHESSURE FIELD, AND THE DOWNHASH OF THE SURFACE AT THE POINT.
C
C.
      THE DEGREE TO WHICH THE TWO SETS OF DOWNWASHES MATCH IS A MEASURE SUB71768
      OF THE ACCURACY OF THE SOLUTION OF THE BOUNDARY VALUE PROBLEM.
                                                                             SUB71718
C
      THE ROOT-HEAN-SOUARE OF THE ERRORS IS GIVEN IN THE ARRAY ALPHA.
                                                                             SUB717.28
                                                                             SUB71738
   96 \text{ IROW} = \text{IROW} + 1
      GU 10 98
                                                                             SUB71746
   97 MUMIT = MOMIT +1
                                                                             SUB7175
   98 CONTINUE
                                                                             SUB71768
                                                                             SUR71778
      MCX = MCCX
                                                                             SU871788
      CUNTINUE
                                                                             SUB71798
C
   77 DO 78 L=1.3
                                                                             SUB7.1898
      NSURF = L
                                                                             SUR7181
                                                                             SUB71829
   78°CALL KOUT(8).
                                                                             SUB71839
      KUUT(8) PRINTS THE GENERALIZED FORCES
                                                                             SUB71840
  100 CUNTINUE
                                                                             SUB71859
      GU 10 1
                                                                             SUB71869
      END
                                                                             SUB75938
       FORTRAN NLSTOU, DECK
                                                                             SU976248
        INCODE
               IBHF
CCONS1
                                                                             SUB78858
             CONS1
      BLOCK DATA
                                                                             SUB78868
                                                                             SUB70070
      COMPLEX A, AA, ANH, CZERO
      COMMON/C1/A(60), AA(50,60), ANH(50,10), CZERO
                                                                             SUB76080
       CUMMON/C2/CLEN.SN, NIY, NHCX, NCCX, NHPX, NCFX, HKER(20), ZKER(20), NGSKRNSUB70890
      CUMMON/C3/NPY,SOUND,NMACH,FMACH(6),MFREU,FREO(10),MAUG,NIOMCX,RHO SUB70100
       COMMON/C4/NMODES, LCOLL, LPRWSH; LPRCO, NOMC5), LIY, IIX, NSORF, ISOLAT
                                                                             SUR/0110
      CUMMON/C5/FW.FC.NCOLS.NOMIT.ALPHA(14).IL(50).HCOR(6).ZCOR(6).MACH
                                                                             SUB78120
      CUMMUN/C6/WXCMN(11), WBCN(11), WBIN(11), WI(90), XCUEL, YCULL, PI, U
                                                                             SUB70130
      CUMMON/C7/CO(10,28,2),NZCO(10,2),EH,EK,+2,NHIX,NCIX,NBO,CBON,NWCY
                                                                             SUB/0140
       GUMMON/C8/IFR, XE(5), YE(3), UX(10), UY(10), WXIMN(11), E1, E2
                                                                             SUB70150
       COMMON/C9/SIX(40,2),SCX(10,2),Y(11),ETA(11),OWY,OWWX,QWCX,CXMN
                                                                             SUS70160
                                                                             SU870170
       NATA PI/3.14159265/
       NATA HCOR/0.08566225,0.18038079,0.23395697:0.23395697,0.18038079,
                                                                             SUR70180
                                                                             SUB70190
      10.08566225/
       DATA ZCOR/0.0.3376524,0.16939531,0.38069041,0.61930959,0.83060469,
                                                                             SUB70200
      10.96623476/
                                                                             SUB70210
                                                                             BUB70228
C
                                                                             SUB70230
      INGSKRN SHOULD BE COMPATIBLE WITH HKER AND ZKER LISTS
                                                                             SUB70240
       DATA NGSKRN/8/
                                                                             SUB70250
      DATA (HKER(I),1=1,8)/0.05061427,0.11119052,0.15685332;0.18134189
                                                                             SUB70260
      X,U.18134189;0.15685332,0.11119052,0.050c1427/
      DATA (ZKER(I), I=1.8)/0.01985507,0.10166676,0.23723380,0.40828268
                                                                             SUB70270
                                                                             SUB70280
      X, U.59171732, N.7627662U, W.89833324, U.98014493/
                                                            24
```

```
DATA E1/8.9000081/,E2/8.0099801/,CZERO/(0.0,0.5)/
                                                                              SUB70300
                                                                              SUB70310
                                                                              SUB71870
       FORTRAN NLSTOU, DECK
       INCODE
               IBMF
                                                                              SU871880
CKFDA
            KFDA
                                                                              SUB71890
      SUBROUTINE KEDA
                                                                              SUB71900
      COMPLEX A, AA, ANH, CZERO
                                                                              SU871910
      COMHON/C1/A(60).AA(50,68).ANN(58,18).CZERO
                                                                              SUR71928
      COHHON/C2/CLEN, SN, NIY, NHCX; NCCX; NNPX; NCPX; HKER(20), ZKER(20), NGSKRNSUB71930
      COMMON/C3/NPY, SOUND, NHACH, FMACH(6), NFREU, FREQ(10), MAUG, MIONCX, RHO SUB71940
      COMMON/C4/NHOTES, LCOLL, LPRNSH, LPRCO, NON(5), ITY, ITX, NSURF, ISOLAT
                                                                             SUB71950
      COMMON/C5/FH,FC,NCOLS,NOMET.ALPHA(10),IL(50),HCOR(6),ZCOR(6),MACH SUB7196U
      COMMON/C6/WXCMN(11), WBCN(11), WBIN(11), WT(90), XCOLL, YCOLL, PI, U
                                                                              SUB71970
      COMMON/C7/CU(10,28,2),NZCO(10,2),EM,EK,H2,NHTX,NCIX,WBO,CBON,NWCY SUB71980
                                                                             SUB71990
      COMMON/C8/IFR_XE(5), YE(3), UX(10), UY(10), WXINN(11), E1, E2
      CQHH8N/C9/Six(46,2),SCX(10,2),Y(11),ETA(11),QNY,QNHX,QNCX,CXMN
                                                                              SUB72000
      READ(5,11)(XF(1),1=1,5)
                                                                              SUB/2010
      READ(5,11) (YE(19), I=1,3), SOUND, RHO
                                                                              SUB72020
      RHO = RHO/100u.0
                                                                              SUB72030
      READ(5,12) NHACH, NFREO, NHODES; LCOLL, LPRWSH, LPRCO
                                                                              SUB72040
      REAU(5,12) NUCX, NUPX, NCCX; NCPX; NIONCX
                                                                              SUB/2050
      READ(5,12) NIY, NUCY, NPY, INKTS, ISOLAT
                                                                              SUB72060
                                                                              SUB72070
      HETS = RECY*NECK + NIY*NCCX
      DO 46 1=1,NHTS
                                                                              SUB72080
   40 \text{ WL(1)} = 1.0
                                                                             SÚB/2090
      If (INNTS.NE.8) READ(5,11) (NI(I), I=1, NHTS)
                                                                              SU87:2100
      MCOLS = HPY & (MMPX + MCPX)
                                                                              SUB72110
      HUIX =
                NCCX*NIONCX
                                                                              SUB72120
      Mx I X=
               NHCX±NIONCX
                                                                              SUB/2130
      0 = TINUR
                                                                              SUB/2140
      BU 4 1=1,5
                                                                             SUB72142
    4:NOM(I)=0
                                                                              SUB72144
      IF (NECY.GE.NIY)
                        60 TO 5
                                                                              SUB72150
      NUMIT = NIY-NHCY
                                                                              SU872160
      READ(5,12) (NOM(I), I=1, NOMIT)
                                                                              SUB72170
    5 READ(5,11) (FHACH(I), I=1; NHACH)
                                                                              SUB72180
      DU 7 I=1,NHACH
                                                                              SUB/2190
      IF(FHACH(I)~LF.0.99)
                             60 10 7
                                                                              SUB72200
      WKITE(6,13)
                                                                             SUB72210
                     A MACH NUMBER GREATER THAN 0.99 HAS BEEN READ IN----SUB72220
   13 FURNAT (7.1H
     1CASE TERMINATED)
                                                                              SUB72230
      CALL EXIT
                                                                              SUB7.2240
    7 CONTINUE
                                                                              SUB72250
      READ(5;11)(FRFQ(1), I=1,NFREQ)
                                                                              SUB72260
      D0 20 \cdot I = 19 NHOUES
                                                                              SUB72270
      DO 20 L = 1,2
                                                                              SUS72280
      DO 10 K = 1.28
                                                                              SUB72290
   in Cu(1,K,L) = 0.0
                                                                              SU872300
      READ(5,12) NCO
                                                                              SUB72310
      NZCU(I,L) = NCO
                                                                              SUR72320
   20 READ(5:11) (CO(1,K,L),K=1,NCO)
                                                                              SUB/2330
      DU 30 1=2.5
                                                                              SUB72340 <
   30 XE(1) = XE(1) - XE(1)
                                                                              SUB72350
      YE(2) = YE(2) - YE(1)
                                                                              SUB72360
      YE(3) = YE(3) - YE(1)
                                                                              SUB72370
                                                                              SUB72380
   11 FORMAT(6E12.8)
                                                                             SUB72390
   12 FURMAT(6112)
      IF(NCIX.GT.40.OR.NWIX.GT.40) GO TO 86
                                                                              SUB72400
      IF (NHCX+NHCY+NCCX+NFY.GT.90°) GO TO 86
                                                                              SUB72410
                                                                              SUB72420
      IF (NPY*(NMPX+NCPX).GT.50) GO TO 86
                                                         25 .
```

```
IF (NWPX.GT.10.OR.NCPX.GT.10.OR.NPY.GT.10) GO TO 86
                                                                              SU972430
      RETURN
                                                                              SUB72440
   86 EM = FMACH(1)
                                                                              SUB/2458
      CALL KOUT (1)
                                                                              SUB72468
                                                                              SUB72479.
      CALL KOUT(5)
                                                                              SUB/2480
      RETURN
      END
                                                                              SUB72490
       FORTRAN NESTOUS DECK
                                                                              SÚB72500
       INCODE IBHF
                                                                              SUB72510
CGEUM
             GEOM
                                                                              SUB72520
      SUBROUTINE GEOR
                                                                              SUB72530
                                                                              SUB7.2548
      COMPLEX A, AA, ANH, CZERO
      COMMON/C1/A(60),AA(50,60),ANM(50,10),CZERO
                                                                              SUB72550
      CUMMON/C2/CLEN, SN, N1Y, NWCX, NCCX, NWPN, NCPX, HKER(20), ZKER120), NGSKRNSUB72560.
      COMMON/C3/NPY, SOUND, NHACH, FHACH(6), HFREQ, FREQ(10), HAUG, NIONCX, RHO SUB/25/0:
      CUMMON/C4/NHOUES, LCOLL; LPRHSH, LPRCO, NOH(5), IIY, IIX; HSURF; ISOLAT
                                                                              SUB72581
      CUMMON/C5/FH, CC, NCULS, NONIT, ALPHA(10), IL(50), HCOR(6), ZCOR(6), HACH SUB/2590
      CUMMON/C6/WXCHN(11), WBCN(11), WBIN(11), WT(90), XCGLL, YCOLL, PI, U
                                                                              SUR7260U
      COMMON/CZ/CO(10,28,2),NZCO(10,2),EM,EK,H2,NNIX,NCIX,WBO,CBON;NHCY
                                                                              SUB72610
      COMMON/CB/IFR,XE(5),YE(3),UX(10),UY(10),HXIMN(11),E1,E2
                                                                              SUB72620 .
      GUMMON/C9/STX(40;2),SCX(10;2),Y(11),ETA(11),QHY,QHHX,QHCX;CXMH
                                                                              SU872630
·C
      WHO = WING ROOT SEMI-CHURD
                                                                             SUB72640
C
      S = SEMI-SPAN
                                                                              SUB72650
Ċ
      WICH = WING TIP CHORD - NORMALIZED ON WHO
                                                                              SUB72660
C
       WILLN = WING TIP L.E. - NORMALIZED
                                                                              SUB72670
      SN = SEMI-SPAN - NORMALIZED
                                                                              SUB72680
C
                                                                              SUB72690
C
      CBO = CONTROL SEMI-CHORD
      FH = 2.4NHIX+1
C
                                                                              SUB72700
C
      FC = 2#NCIX+1
                                                                              SUB72710
                                                                              SUB72720
       W_{H,0} = XE(3)/2.8
                                                                              ŠU87273U
      CLEN = XE(4)/HBU
                                                                              SUB72740
       S = YE(3)
                                                                              SUB72750
       HTCN = (XE(3)-XE(2))/HBO
                                                                              SUB/2760
       MILEN = XE(S)/NBO
      SN = S/H80
                                                                              SUB72770
       CBO = (XE(5) = XE(4) = 2.0
                                                                              SUB72780
      F1=FW
                                                                              SU8/2790
      F2 = F1 * P1/2.
                                                                              SUB72800
       J = NWIX
                                                                              SUB72810
      COMPUTE CHORDWISE INTEGRATION AND COLLOCATION STATIONS
                                                                              SUB72820
C:
C
      FIRST ON THE WING SURFACE
                                                                              SU872830
       DO 5 I=1 NHIX
                                                                              SUB72840
       F2 = F2 -2.*P.1
                                                                              SUB72850
       SIX(J,1) = SIN(F2/F1.)
                                                                              SUB72860
       11 = FLOAT(1)/FLOAT(NIONGX) + 0.99
                                                                              SU872870
       SCX(I1,1) = -SIX(J,1)
                                                                              SUB72880
    5 J=J-1
                                                                              SUB72890
       F1=FC
                                                                              SUB72900
       F2 = E1 * P1/2.
                                                                              SUB72910
       J = NCIX
                                                                              SUB72920
       THEN: ON THE CONTROL SURFACE
                                                                              SUB72930
C
       DO 6 I=1. NCIX
                                                                              SUB/2940
       F2 = F2 - 2 \cdot *PI
                                                                              SUB72950
       SIX(J,2) = SIN(+2/F1)
                                                                              SUB72960
       I'1 = FLOAT(1)/FLOAT(NIONCX) + 0.99
                                                                              SUB72970
       SCX(I1,2) = -SIX(J,2)
                                                                              SUB72980
     6 J=J-1
                                                                              SUB72990
       F1 = 4*NIY
                                                                              SUB73000
       F2=0.0
                                                                              SUB/3010
      COMPUTE SPANNISE INTEGRATION AND COLLOCATION STATIONS
                                                                              SUB73020
C
```

26

```
SUB73030
          DO 8 I=1.NIY
                                                                                   SUB73040
          Y(13) = SIN(F2/F1)
                                                                                   SUB73050
          F2 = F2 + PI
          ETA(1) = SIK(F2/F1)
                                                                                   SUB73060
        8 F2 = F2 +P1
                                                                                   SUB73070
   Ċ
          COMPUTE KING SENI-CHORDS AND MID-CHURD LOCATIONS AT THE
                                                                                   SUB73080
                                                                                   SUB/3090
          SPANNISE COLLUCATION AND INTEGRATION STATIONS
          PIB = YE(2)/YE(3)
                                                                                   SUB73100
          POR =1.0-PI8
                                                                                   SUB73110
To the second
          CBOH = (XE(5)-XE(4))/(2.0*HBO)
                                                                                   SU873120
                                                                                   SUB73130
          CXHH = CBOH + XF(4)/HBO
          DU 16 I=1,NIY
                                                                                   SUB73140
          IF(ETA(I).LE.PIB)
                               GO TO 12
                                                                                   SUB73150
          F1 = HILENO(EIA(I)-PIB)/POB
                                                                                   SUB73160
          IF (Y(1).LE.PIB)
                                                                                   SUB/3170
                              GU TO 13
          F2 = NTLEN*(Y(T)-PIB)/POB
                                                                                   SUB/3180
          GU 10 14
                                                                                   SUB73190
       22 F1 = 0.0
                                                                                   SUB73200
       13 F2 = 8.0
                                                                                   SUB73210
SUB73220
       14 \text{ MBIR}(I) = 0.5*(2.0-F1)
          MXIMM(I) = WBIM(I) +F1
                                                                                   SUB73230
          WHCH(I) = 0.5*(2.0-62)
                                                                                   SUB 7.3240
                                                                                   SUB73250
       16 \pm x ChN(1) = HBCN(1) \pm F2
                                                                                   SUB73260
       36 RETURN
          END
                                                                                   SUB73270
           FORTRAN NESTOU, BECK
                                                                                   SUB73280
                                                                                   SUB7-3290
           INCODE
                    IBHF
    CXS
                 XS
                                                                                   SUB73300
          FUNCTION XS(L,NS,13,J3)
                                                                                   SUB73310 :
CUMPLEX A.AA.ANH, CZERU
                                                                                   SUB73320
          CUMMON/C1/A(64), (60,60), ANH(50,10), CZERO
                                                                                   SU873330
          COMMONYCZ/CLEN, SN, NIY, NHCX, NCCX, NHPX, NCPX, HKER(20), ZKER(20), NGSKRNSUB73340
          COHNON/C3/NPY,SOUND,NMACH,FMACH(6),NFRÉO,FREO(10),MAUG/NIONCX,RHO SUB/3350
          COMMON/C4/NMONES, LCOLL, LPRWSH, LPRCO, NOM(5), IIV, MIX, WSURF, ISOLAT
                                                                                   SUB73360
          CUMHON/C5/FW.FC. NCOLS, NOMIT, ALPHA(10), IL (50), HCOR(6), ZCOR(6), MACH SUB/3370
          COMMON/C6/WXCHN(11), WHCN(11), WBIN(11), WI(90), XCOLE, YCOLL, PI, U
                                                                                   SUB73380
          CUHYON/C7/CU(10,28,2),NZCO(10,2),EH,EK,H2,NHIX,NCIX,NBO,CBON,NHCY\SUB73390:
          COMMON/CB/IFR, XE(5), YE(3), UX(10), UY(10), WXIMN(11), E1, E2
                                                                                   SUB/3400
                                                                                   SUB73410
          CONHON/C9/SIX(40,2),SCX(10,2),Y(11),ETA(11),QWY,QWWX,QWCX,CXMN
          GO 10 (10,40), L
                                                                                   SUB73420
       10 GU TO: (20,30), NS
                                                                                   SUB73430
          XS = WXCHN(33) + WBCN(33) * SCX(13,1)
                                                                                   SUB73440
                                                                                   SUB73450
          RETURN
                                                                                   SUB73460
       30 \times S = C \times MN + CHON * SCX(13,2)
                                                                                   SUB73470
          RETURN
       4n GU 10 (50,60), NS
                                                                                   SUB73480
                                                                                   SUB73490
       50 \text{ XS} = \text{WXIMN}(J3) + \text{WBIN}(J3) * \text{SIX}(I3,1)
                                                                                   SUB73580
           RETURN
       60 XS = CXMN + CRON * SIX(13,2)
                                                                                   SUB73510
           RETURN
                                                                                   SUB73520
           END
                                                                                   SU873530
           FORTRAN NESTOU, DECK
                                                                                   SUB/3546
            INCODE
                    IBMF
                                                                                   SUB13550
SUB/3560
    CBESL
                 RESL
                                                                                   SUB73570
           FUNCTION BESL(X)
           IF (X.GT.2.0) - GO TO 50
                                                                                   SUB73580
                                                                                   SUB73590
           T=X/3.75
           T=T#T
                                                                                   SUB73600
           #$11=0.5+T*(#.87890594+T*(0.51498869+T*(#.15084934+T*(#.02658733+T$UB73610
                                                                                   SUB73620
         1 + (0.00301532 + (0.00032411))))))
                                                                                   SUB73630
           ASI1=BSI1+X
                                                      . 27.
```

```
Y=X/2.0
                                                                                SUR73640
      BSK1=X*ALUG(Y)+BSI1+1.0
                                                                                SU873650
      Y=Y=Y
                                                                                SUB33660
      HSK1=BSK1+Y+(#.15443144+Y+(-0.67278579+Y+(-0.18156897+Y+
                                                                                SUB73670
     1(-0.01919402+Y+(-0.00110404+Y+(-0.00004686))))))
                                                                                SUB73680
      BESL =BSK1/X
                                                                                SUB73690
      GU 10 60
                                                                                SUB73700
50
      Y = 2.0 / X
                                                                                SUB73710
      BSK1=1.25331414+Y*(0.23498619+Y*(-0.03655620+Y*(0.01504268+Y*
                                                                                SUB73726
     1(-0,00780353+Y*(0.00325614+Y*(-0.00068245))));)
                                                                                SUB73730
      RESL = BSK1/(SORT(X) * EXP(X))
                                                                                SU873740
   60 RETURN
                                                                                SUB/3750
      END
                                                                                .SUB73760°
       FORTRAN NESTOU, DECK
                                                                                SUB73770
       INCODE
                1BMF
                                                                                SUB73780
CCRNL
             CRNL
                                                                                SUB73790
      COMPLEX FUNCTION CRNL(CK,X,Y,CH,B2)
                                                                                SUB73800
      COMMON/C2/CLFN, SN, NIY, NHCX, NCCX, NHPX, NCPX, HKER(20), ŽKER(20), NGSKRNSUB73818.
      REABS(Y)
                                                                                SUB73820
      #2=k#R
                                                                                SUB73830
      CK1 = CK+R
                                                                                SUB73840
      G1 = 0.0
                                                                                SUB73850
      G3 = 0.0
                                                                                SUB73860
      G4 = 0.0
                                                                                SUB73870
      S2 = X*X + B2*R2
                                                                                SUB 73880
            SORT(S2)
                                                                                SUB73890
      U1 = (C\tilde{H}*S-X)/(B2*R)
                                                                                SUB/3900
      UK = CK1*U1
                                                                                SUB/3910
      10 20 I = 1, NGSKRN
                                                                                SUB73920
      UZ = U1 + ZKER(T)
                                                                                SU873930
      UZ2 = UZ**2
                                                                                SUB73940
      G=UK*ZKER(I)
                                                                                SUB73950
      F = HKFR(1)/ SORT(1.0+UZ2)*UZ*U1
                                                                                SUB 7.3960
      G3=G3+F*COS(G)
                                                                                SU873970
      G4=G4+F*SIN(G)
                                                                                SUB/3980
      V = 1.\tilde{N} - ZKFR(1)**2
                                                                                SUB7.3990
      F = HKER(I^0) * 2 \cdot 0 * V * EXP(-CK1 * V) / SQRT(1 \cdot 0 + V)
                                                                                SUB74000
   20 G1=G1+F
                                                                                SU874010
      G7 = .61 + .65
                                                                                SUB74020
      XS = X/\hat{S}
                                                                                SUB74030
      IF (CK.NE.0.0)
                       GO TU 22
                                                                                SUB74040
      F14 = 1.0
                                                                                SUB74050
      60 10 23
                                                                                SUR74060
   22^{\circ} F14 = CK1*BFSL(CK1)
                                                                                SUB74070
   23 G1=CK1*G4-F14-XS*COS(UK)
                                                                                SÚB74080
      G2=CK1*G7+XS*SIN(UK)
                                                                                SUB74090
      XK = CK + X
                                                                                SUB74100
      Cu =
             COSCXKA
                                                                                SUB74110
             SIN(XK)
                                                                                SUB74120
      CRNL = CMPLX((CU*G1+S1*G2)/k2,(CO*G2-SI*G1)/R2)
                                                                                SUB74130
      RETURN
                                                                                SUB74140
      ÉND
                                                                               SUB74150
       FORTRAN NESTOU, BECK
                                                                                SUB74530
       INCODE
               IBMF
                                                                                SUB74540
CCORD
             ČORD
                                                                                SUB74550
      SUBROUTINE CORD
                                                                                SUB/4560
      CUMPLEX A, AA, ANM, CZERO
                                                                                SUB74570
      COMPLEX AK, H2, TRM, D1, CRNL
                                                                                SUB74580
      CUMMON/C1/A(60),AA(50,60),ANM(50,10),CZERO
                                                                                SUB74590
      CUMMON/C2/CLFN, SN, NIY, NHCX, NCCX, NHPX, NCPX, HKER (20), ZKEP 120), NGSKRNSUB74600
      CUMMON/C3/NPY,SUUND,NMACH,FMACH(6),NFREU,FREQ(10),MAUG;NIONCX,RHO SUB74610
28
```

```
CUHHON/C4/HHODES, LCOUL, LPRWSH, LPRCO, NON(5), IIY, IIX, WSURF, ISOLAT
                                                                             SUB74629
   COHHON/C5/Fk,FC,NCOLS,NOHIT,ALPHA(10),IL(50),HCOR(6),ZCOR(6),HACH SUB74630
   COMMON/C6/WXCHM(11),WHCM(11),WHIM(11),WT(90),XCOLL,YCOLL,PI,U
                                                                             SUB7464#
   COHHOR/C7/CU(10:28:2),HZCO(15:2),EH:EK:H2,NH1X;HCIX;HBO:CBON:NHCY SUB74650
   GQHHQN/C8/IFR,XE(5),YE(3),UX(10),UY(10),WX;HN(11),E1,E2
                                                                             SUB74668
   GÜHHÜN/C9/SIX(40,2),SÖX(10,2),Y(11),ÉTA(11),QHY,QÄXX,QHCX;CXHN
                                                                             SUB74670
   THIS SUBROUTTRE CONSTRUCTS A ROW OF THE DOWNWASH MATRIX
THE PRESSURE SERIES IS A PRODUCT OF CHERYSHEY POLYNOMIALS IN THE
                                                                             SUB74680
                                                                             SUB74690
     NEGATIVE OF PERCENT SEMI-CHORD FROM THE MID-CHORD AND PERCENT
                                                                             SUB74700
     SEMI-SPAN FROM THE ROOT.
                                                                             SUB74710
   DO 6 JC=1,NCQLS
                                                                             SUB74728
 6 A(JC) = CZERO
                                                                             SU874738
   IC1 = 0
                                                                             SUB74740
   MIX = MMIX
                                                                             SUB74750
   QWX = -0WWX*SW**2/(8.0*PI)
                                                                             SUB74760
   NPX = NWPX
                                                                             SUB74778
   THE DO 14 LUOP COMPUTES THE NON-SINGULAR PORTION OF D(N,M)
                                                                             SUB74780
   OUF TO BOTH SURFACES
                                                                             SUB7479A
   NO 14 HSURF=1.2
                                                                             SUB7480U
   TH CHSURF.NE. HSURF. AND. ISOLAD. NE. D.> GO 🚟 13
                                                                             SUB74810
   00 12 IY=1, XIY
                                                                             SUB74820
   ETAT = SNEETACLY9
                                                                             SUB74830
   E12 = ETA(1Y) **2
                                                                             SUB74840
   IF (NPY.GT.1) CALL CHEH (NPY-1, ETA (IY), UY(2))
                                                                             SUB74850
   CT(T) = 1.0 - FT2
                                                                             SUB74860
   DU 3 K=2,NPY
                                                                             SUB74870
 \Xi UY(K) = E\(\frac{1}{2}\)\(\frac{1}{1}\)\(\frac{1}{2}\)\(K)
                                                                             SUB74880
     DU 10 IX=1,NIX
                                                                             SUB74890
       XI = XS(2, MSURF, IX, IY)
                                                                             SUB74900
       XID = XCOUL -XI
                                                                             SUB74910
   AK = CRNL(EK, XID, YCOLL-ETAI, EH, B2) + CRNL(EK, XID, YCOLL+ETAI, EH, B2)SUB74926
       IC = IC1 + 1
                                                                             SUB74930
   H2 = AK + OHX * GYY
                                                                             SUB74940.
   TF(NPX.GT:1) CALL CHEB(NPX-1,-SIX(IX, MSURF), UX(2))
                                                                             SUB74950
   UX(1) = 1.0 - SIX(IX, MSURF)
                                                                             SUB74960
   DO 4 K=2,NPX
                                                                             SUB74970
 4 HX(K) = (1.0 +SIX([X, MSURF]) #UX(1) #UX(K)
                                                                             SUB74980
      ADD AN INCREMENT TO EACH ELEMENT OF THE ROW FOR (XI, ETAI) **
                                                                             SUB74990
       DO 10 NY=1, NPY
                                                                             SUB75000
   TRM = H2 * UY(NY)
                                                                             SUB75018
   00 10 NX=1, HPX
                                                                             SUB75020
   A(TC) = A(TC) + TRM + UX(NX)
                                                                             SUB75030
10 IC = IC+1
                                                                             SUB75040
   ** IC EQUALS NPY*NWPX+1 AT THE END UF THE FIRST PASS **
                                                                             SUB75050
12 CONTINUE:
                                                                             SU875060
     NIX = NCIX
                                                                             SU875070
   QWX = -QWCX*SH**2/(8.0*PI)
                                                                             SUB/15080
     NPX = NCPX
                                                                             SUB/5090
     JC1 = NPY*NWPX
14
                                                                             SUB/5100
   IC1 = 0
                                                                             SUB75110
   NPX = NHPX
                                                                             SUR75120
   XCOLS = XS(1/NSURF + 1/LX + L1Y)
                                                                             SUH75130
   Y2 = Y(11Y)**2
                                                                             SUB/5140
   CALL CHEB(NPY-1,Y(IIY),UY(2))
                                                                             SUB75150
   UY(1) = -2.0
                                                                             SUB75160
   DU 15 K=2.NPY
                                                                             SUB75170
                                                                             SUB75180
15 UY(K) = -2 \cdot U \times Y \times Y \times UY(K)
                                                                             SUB75190
   DO 40 MSURF=1, NSURF
      THIS LOOP ADDS THE CONTRIBUTION OF THE SINGULAR INTEGRAL
                                                                             SUB/5200
       ALONG THE LINE FROM THE WING L.E. TO THE CULLOCATION POINT
                                                                             SUB/5210
   IF (MSURF.NE.NSURF.AND.ISQLAT.NE.O) GO TU 23
                                                                             SUB15220
```

C

C

C

E

C

C :

C

C

```
SUB75230
      IF (NSURF.LE. HSURF)
                            GO TO-16
                                                                               SUB75248
      UPLIH = PI
                                                                               SUB75250
      GU 10 18
                                                                                SUB75250
   16 \times I = SCX(IIX, NSURF)
                                                                               SUB75270
      UPLIM = -ATAN(SURT(1.0-XT##2)/XT)
                                                                               SUB75280
      IF(UPLIH.ET.0.0) UPLIH=UPLIH+PI
                                                                               SU875290
   18 OWSNG = FLOAT(2*NIY)*UPLIM/8.0
                                                                               SUB75301
      00 22 N=1,6
                                                                               SUB/5310
      IC' = 1C1+1
Č
        ** THIS LUOP CONSTRUCTS D(O, H) . M=0,1,... NPX-1
                                                                               SUR75320
                                                                                SUB75330
        VINI = UPLIM#ZCOR(N)
        C = COS(VENT)
                                                                                SUB75340
      CALL CHEB(NPX-1, C) UX(2))
                                                                                SuB15350
                                                                                SUB75360
      UX(1) = 1.0 + 0.0
                                                                                SUB75370
      NU 19 K=25NPX
                                                                                SUB75380
   19 UX(K) = (1.0 -C)*UX(1)*UX(K)
                                                                                SUB75390
      ARG = EK*(XCOLS -WXCHN(IIY) +C*HBCN(IIY))
                                                                                SUB 15395
      IF (HSURF.EO.2) ARG=EK*(XCOLS-CXHN+C*CBOA)
                                                                                SUB75400
         C1 = COS(ARG)
                                                                                SUB35410
         SI = SPRT(1.0 - C1**2)
                                                                                SU875420
      D1 = CMPLX(C1, -S1) *HCOR(N)
                                                                               SUB/5430
       NO 22 NY=1, NPY
                                                                                SUB75440
       TRM = QWSNG+UY(NY)+It
                                                                                SUB75450.
       Du: 22'-NX=1 a RPX
                                                                                SU875460
       AGEC) = AGEC) + TRM#UX(NX)
                                                                                SUB 75470
   22 \text{ IC} = \text{IC+1}
                                                                                SUR75480
   23 IC1 = NPY*NHPX
                                                                                SUB75490
   40 \text{ NPX} = \text{NCPX}
                                                                                SUB75500
       RETURN
                                                                                SUB7/5510
                                                                                SUR74160
       FORTRAN NESTOU, DECK
                                                                                SUB74170
        INCODE IBME
                                                                                SUB74180
CZDZX
             ZDZX
                                                                                SUB74190
       SUBROUTINE ZDZX(MUDE, DZ;Z)
                                                                                SUB/4200
       COMPLEX A, AA, ANM, CZERO
       GUHMON/C1/A(60), AA(50;60), ANM(50,10), CZERO
                                                                                SUB74210
       CUMMON/C2/CLFN,'SN, HIY, NWCX, NGCX, NWPX, NGPX, HKFP.(20), ZKER(20), NGSKRNSUB/4220
       CUMMON/CJ/NPY, SOUND, NMACH, FMACH(6), NFREU, FREQ(10), MAUG, NIONCX; RHO SUB74230
       COMMON/C4/NMODES, LCOLL, LPRWSH; LPRCO, NOM(5), IIY, IXX, NSURF, ISOLAT
                                                                                SUB74240
       CUMMON/C5/FW.FC.NCOLS.NOMIT.ALPHA(10); It (50), HCOR(6), ZCOR(6), MACH SUB74250
       COMMON/C6/WXCHN(11), WBCN(11), WBIN(11), WI(90), XCUEL, YCOLL, PI, U
                                                                                SUB/4260
                                                                                SUB74270
       COMMON/C7/CUCLO.28.2),NZCO(10.2),EH;EK,n2,NWIX;NCIX,WBO,CBON,NHCY
       COMMON/C8/IFR, XE(5), YE(3), UX(10), UY(10), WXIMN(11), E1, E2
                                                                                SUB/4280
       COMMON/C9/S1x(40,2); SCXC10,2), YC11), ETAC11), OHÝ, OHX, OHCX, CXMN
                                                                                SUB74290
                                                                                SUB74300
       PX = XCOLL * WBO
                                                                                SUB74310
       IF(NSURF.GT.1)
                        PX≒PX→CLEN##R0
                                                                                SUB/4320
       PY = YCOLL * 480
                                                                                SUB74330
       Z= CO(MODE,1,NSURF)
                                                                                SUB74340
       n2 = 0.0
                                                                                SUB74350
       K = 2
                                                                                SUB74360
       YX = PY/PX
                                                                                SUB/4370
       PPX = PX
                                                                                SUB74380
       DU 40 N = 2,7
                                                                                SUB74390
       PXY = PPX
                                                                                SUB74400
          = N-1
                                                                                SUB74410
       nú 30 M = 1.N
                                                                                SUB7:4420
       IF(K.gr.NZCU(MODE,NSURF)) GO'TO 50
                                                                                SUB/4430
       ,ZP = PXY * CO(MODE,K,NSURF)
                                                                                SUB/4440
       Z = Z + ZP
                                                                                SUB 74450
       DZ = DZ + ZP * F
                                             30 .
```

```
SUB7446U-
      PXY = PXY + YX
                                                                              SUB 24470
         = F ,= 1.0
                                                                              SUB74480
   30 K = X + 1
                                                                              SUB74490-
   40 PPX = PPX * PX
                                                                              SUB74500
   50 DZ = DZ/PX
                                                                              SUB/4510
      RETURN
                                                                              SUB 74520
      END
                                                                              SUB75520 A
       FORTRAN NESTOU-DECK
                                                                              SUB75530
       INCODE IBHF
                                                                              SU875540
CCGRFU
             CGRED
                                                                              SUB75550:
      SUBROUTINE CORFO(V. 18.3C)
                                                                              SUB75560
      CUMPLEX ANM, CZFRO
                                                                              SUB75570
      DIMENSION V(2.1)
      CUMMON/C1/A(2,60),AA(2,50,6U),ANH(5U,10),CZERÔ
                                                                              SUB/5580
      COMMON/C2/CLEN, SN, NIY, NHCX; NGCX, NHPX; NCPX; HKER(20), ZKER(20), NGSKRMSUB75590
      CUMMON/C3/HPY, SUUND, NYACH, EMACH(6), NFREU, FREQ(10), MAÜG; NÎONCX, RHO SUB/75600
      COMMON/C4/NMONES LCULL, LPRHSH, LPRCO, NOMLS), 11Y, 11X, MSURF, ISOLAT
                                                                              SUB/561U
      CUMMON/C5/FW.FC.NCOLS.NUNIT.ALPHA(14).IT (50).HCOR(6).ZCUR(6).HACH
                                                                              SUB7562U
      CUMMON/C6/WXCMN(11), WBCN(11), WBIN(11), WI.(90), XCOEL, YGOLL, PI, U
                                                                              SUB75630
      COMMON/C7/CUGLO.28.2), NZCO(10.2), EN.EK. 62. NWIX, NCIX- HBO. CHON, NHCY
                                                                              SUB/5640
                                                                              SUB75650
      CUMMUN/C8/IFR, XE(5), YE(37, UX(10), UY(1:0), WXIMN(11), E1, E2
                                                                              SUB75660:
      CUMMON/C9/SIX(40,2),SCX.40,2),YG11),ETA(11), BHY, OHHX, GHCX,CXHN
      RMN = SURT(AA(1,TR,IC) + AA(2,IR,IC) + 2)
                                                                              SUB75670
                                                                              SUB75680
      IF (AA(2, IR, 1C), LE, E2) GO TO 30
                                                                              SUB75690
      CR = AA(1, IR, IC)/RMN
                                                                              SU875.700
      CI = AA(2,1R,IC)/RMN
                                                                              SUB7.5710:
      DU 20 N=IC, MAUG
                                                                               SUB75720
      TI = CR*AA(1, IR, N) + CI*AA(2, IR, N)
      AA(2,IR,N) = CR#AA(2,IR,N) - CI#AA(1,IR,N)
                                                                              SUB75730
                                                                              SUB75740
   20 \text{ AA}(1,1R,N) = 11
   30 RAN = SORT(V(1, 10)**2 + V(2) 16)**2)
                                                                              'SUB75750
                                                                               SUB75760
      THERAN, LE.EZ) GO TO GO
                                                                              SUB 15770
      RAN = SORT(RAN*#2 + RMN**2):
                                                                               SUB/5780
      CK = V(1,IC)/RAN
                                                                               SUB/5790
      CI
         = V.(2. IC) / RAN
                                                                               SUB/5800
      RMN = RMN/RAN
                                                                               SUB75810
      DU 50 N=1C. MAUG
      AIR = RMN*AA(1)IR_NN) + CR*V(1)N) + CI*V(2)N)
                                                                               SUB/5820
      AlT = RMN*AA(2, 1R, N) + CR*V(2, N) + CI*V(1, N)
                                                                               SUB/5830
       VR = RHN*V(1,N) - CR*AA(1,IR,N) + CI*AA(2,IR,N)
                                                                               SUB/5840
                                                                               SUB/5850
      VI = RMN*V(2,N) = CR*AA(2,IR,N) = CI*AA(1,IR,N)
                                                                               SUB75860
       AA(J.IŘ.N) = ATR
                                                                               SUB75870
       AA(2,IR,N) = AII
                                                                               SUB75880
      \Psi(1,N) = VR
   '50 V(2,4) = VI
                                                                               SUB75890
                                                                               SUB75900
    60 RETURN
                                                                               SUB 75910
       END.
                                                                               SUB7592.0
        FORTRAN NESTOU, DECK
$
                                                                               SUB75930
        INCODE
                IBMF
$
                                                                               SUB/5940
CXLSQ
             XLSU
                                                                               SUB/5950
       SUBROUTINE XLSD
       COMPLEX À AA AANM, CŽERO
                                                                               SU875960
       COMMON/C1/A(AI), AA(50, 60), ANM(50, 10), CZERU
                                                                               SUB 75970
       COMMON/C2/CLEN,SN,NIY,NHCX,NCCX,NHPX,NCEX,HKER(20),ZKER(20),NGSKRNSUB/5980
       CUMMON/C3/NPY, SOUND, NMACH, FMACH(6), NFREW, FREQ (10), MAUG, NIONCX, RHO SUB75990
                                                                               SUB76000
       COMMON/C4/NMONES, LCOLE, LPRWSH, LPRCO, NOM(5), 114, 11X, NSURE, ISOLAT
       COMMON/C5/FW.FC.NCOLS.NOMIT:ALPHA(10),IL(50),HCOR(6).ZCUR(6).MACH SUB/6010
       COMMON/C6/WXCAN(11), WBCN(11), WBIN(11), WI(90), XCOLL, YCOLL, PI, U
                                                                               SUB76020
                                                                              SUB76030
       CUMMON/C7/CO(18,28,2),NZCO(10,2),EM.EK. 2,NWIX,NCIX,WBO,CBON,NWCY
                                                                               SUB76040
       COMMON/CB/4fR, XE(5), YE(3), UX(10), UY(10), WXIMN(11), E1, E2
                                                                               SUB/6050
       CUMMON/C9/SIX(40,2),SCX(10,2),Y(11),ETA(11),QHY,QHHX,QHCX,CXMN
 31
```

I

```
11 = 1
                                                                               SUR76060
      TO 136 I=1 cNCOLS
                                                                               SU276070
      RII = CASS(AA(I1,I))
                                                                                SUB76980
      IF(kII.LE.E2) GO 49 135
                                                                                SŰB76090
      IL(1) = I1
                                                                                SÚB76100
      11 = 11 + 1
                                                                                SUB76134
      GU 10 136
                                                                               SUB/6120
  135 \text{ TL}(I) = -1
                                                                               SUB76138.
      112 = NCOLS - 1 - (1-11)
                                                                                SUB76140
      NU 1135 II=11,112
                                                                                SUB76156
1135 CALL CGRED(AA(11+1,1),[1,1+1)
                                                                               SUB/6160
      NO 2135 L=1,NHOÚFS
                                                                               SUB76170
      ML = NCOLS & L
                                                                                SU876180
2135 ALPHA(L) = SORT(ALPHA(L)**2 + CABS(AA(112+1,ML))**2)
                                                                               SUB/6190
  136 CUNTINUE
                                                                               SUB76209
      SOLVE FOR THE COEFFICIENTS BY BACK SUBSTITUTION
                                                                               SUB76210
 140 II = NCOLS
                                                                                SuB/6220
      No 150 I = 1,400LS
                                                                               SUB/5230
      DO 156 L=1. NHODES
                                                                               SUB76240"
  150 ANH(T_{i}L) = CZERU
                                                                               SUB76250
      00 210 J=1,NCOLS.
                                                                               SUB/6260-
      IF (IE(II).EE.0) GO TO 210
                                                                               SUB76270
      JI = IL(I:I)
                                                                                SUB/6280
      DU 206 L=1,NMODES
                                                                               SUB/6290.
      ML = NCOLS + 1.
                                                                               SUB/6300
      IF(II-NCOLS) 170;190,220
                                                                               SUB/6310
  176 IK = II + 1
                                                                               SUB76320
      NO 180 K=IK, NCOLS
                                                                               SUB76339
  180 ANN(II.L) = ANN(II.L) - AA(JI.K) ANN(K.L)
                                                                               SUB/6340
  190 ANHULL, L) = (\Lambda NM(JI)L) + AA(JI)ML))/AA(JI)II)
                                                                               SUB76350
  200 CUNTINUE
                                                                               SUB76360
  210 II = II - 1
                                                                                SUB/6370
  220 RETURN
                                                                                SUB76309
      END
                                                                               SUB76390
       FORTRAN NESTHE DECK
                                                                                SUB76400
        INCODE IBMF
$
                                                                                SUB76410
CCHER
             CHEB
                                                                                SUB76420
      SUBROUTINE CHER(N1, X, UX)
                                                                                SUB76430
      DIMENSION UX(1)
                                                                                SUB 76440
      DU 10 I=1,N1
                                                                                SUB76450
   10 \text{ UX}(1) = 0.0
                                                                                SUB76460
      yx(1) = 1.0
                                                                                SUB76470
      IIx(2) = 2.6*X
                                                                                SUB/6480
      IF (N1.LT.3)
                    RETURN
                                                                               SUB76490
      .00 20 T=3,N1
                                                                               SUB76500
   20 \text{ Ux}(1) = 2.0 * \text{X} * \text{UX}(1-1) - \text{UX}(1-2)
                                                                               SUB76510
      RETURN
                                                                               SUB76520
                                                                               SUB76530
       FORTRAN NESTOU, DECK
                                                                               SUB76540
       INCODE
                IBME
                                                                               SUB76550
CFORC
             FORC
                                                                               SUB76560
      SUBROUTINE FORC(NWICX, NCICX, NICY, YEIA, SICX, WBICN, LPR)
                                                                               SUB76570
      CUMPLEX A,AA,ANM,CZERO,GFORC,DELP,WASH,APR,DWASH,CWASH,PR
                                                                               SUB7/6580
      DIMENSION YETA(1), SICX(10, WBICN(1)
                                                                               SUB76590
      DIMENSION DWASH(90:10),PR(90:10).CWASH(40:10)
                                                                               SUB76604
      DIMENSTON GEORG(10,10,3), NELP(10), WASH(10)
                                                                               SUB70370
      COMMON/C1/A(60),AA(50,60),ANM(50,10),CZERO
                                                                                SUB76620
      CUMMON/CZ/CLEN, SN, NIY, NWCX, NCCX, NWPX, NCYX, HKER(20), ZKER(20), NGSKRNSUB/6630
      CUMMUN/C3/NFY, SUUND, NMACH, FMACH(6), NFREW, FREQ(10), MAUG, NIONCX, RHO SUB76640
                                                                               SUB 76650
      CUMMON/C4/NMOURS, LCULL, EPRWSH, EPRCO, NOM (5), IFY, IIX, NSURF, ISOLAT
```

```
CUMMON/C5/FW,FC,NCOLS,NOWFT,ALPHA(10),IL(58),HCOR(6),ZCUR(6);MACH SUB/6660
     CUMMON/C6/WXCHN(11), WBCN(11), WBIN(11), WT(90), XSOLL, YCOLL, PI, U
                                                                           SUB76670
      CUMMON/C7/CU(10,28,2), NZCO(10,2), EM, EK, H2, NHIX, NCIX, NBD, CBON; NHCY
                                                                           SUB76680
                                                                           SUB76690
     CUMMON/C8/IFR.XE(5),YE(3),UX(10),UY(10),HXINH:111),E1,E2
      COMHON/C9/S1X(40,2),SCX(10,2),Y(11),ETA(11),OHY,QNHX,QNCX,CXMN
                                                                           SUB76700
                                                                           SUB/6710
     COMMON/CPR/APR(90,600,1HOD,1ROW
                                                                           SUB76720
      EUULVALENCE (GFÜRC.AA); (A, HASH), (HASH, DFLP)
                                                                           SUB76730
      SUB76740
      EUUIVALENCE (CHASH(1,1),APR(1,41))
                                                                           SUB767.50
      ONF = 0.5*RHO*(U*HBO*SN)**2 #ONY
                                                                           SUB76760
      AF(LPR.NE.09) HO TO 2
                                                                           SUB75770
     ΦO Î I=Î,NMQDFS.
                                                                           SUB76780
      DU 1 J=1.NMUDES
                                                                           SUB76790
      00 1 K=1,2
                                                                           SUB76800
      GFORC(I_{J}J_{J}K) = CZERU
                                                                           SUB76810
    2 IC1 = 0
      NICX = NHICX
                                                                           SUB76820
                                                                           SUB76830
      NPX = ANDX
                                                                           SUB/6840.
      OMFORC = UMF*OMMX
      THON = 1
                                                                           SUB76850
      LANTI = 40
                                                                           SUB76860
                                                                           SUB 1687 U
      IF(LPR.NE.0) [MNT1 = 10
      NO. 1000 NS=1.2
                                                                           SU876880
      NSURF = NS
                                                                           SUB7.6890
        PFAC = SN/CHON
                                                                           SUB76900
        DO 900: ITY=1, NICY
                                                                           SUB76910
          YCOLL = YFTA(11Y)
                                                                           SU8/6920
      ** YOUL, AND LATER XCOLL, ARE USED HERE TO DENOTE INTEGRATION
                                                                           SU97.6930
         STATIONS RECAUSE WE USE SUBROUTINE ZUZX TO COMPUTE THE
                                                                           SUB7694U
C
         DISPLACEMENT THROUGH WHICH THE PRESSURE ACTS TO DO WORK
                                                                           SU87695.0
                                                                           SU87.69611
          Y2' = YCULD**2
                                                                           SUB76970
      IF (NPY.GT.1)
                    CALL CHER(NPY-1, YCOLL, UY(2))
                                                                           SU87698U
      HY(1) = 1.0 - Y2
                                                                           SUB/6990
      IF(PR:NE.0) UY(1)=SORT(1.0-Y2)
                                                                           SU877000
      00 3 K=2,NPY
                                                                           SUB77910.
    3 UY(k) = Y2*UY(1)*UY(K)
          IF(NSURF.EQ.1) PEAC=SN/WBICH(IIY)
                                                                           SU877020
      YCOLL = SN*YCOLE
                                                                           SUB77025
          DO 800 LIX=1, NICX
                                                                           SUB77030.
            LMNI = TRIX PEMNITERINSURF-1)
                                                                           SUD17040
            XCOLL = SICX(LMNT)
                                                                           SUB/7050
      TF(NPX GT.1) CALL CHEBSNPX-1, XCOLL, UX(2))
                                                                           SUB77060
      \ddot{U}X(1) = 1.0 + XCOLE
                                                                           SU877070
      LF(EPR.NE.0) UX(1)=SQRT(UX(1)/(1.0+XCOLL))
                                                                           SUB77080
      BU 4 K=2. NPX
                                                                           SUB77090
                                                                            SUB/7100
     HX(K) = (1.0 + XCOLL) * UX(1) * UX(K)
            IC = ICI +1
                                                                            SUB77110:
            DO 18 J=1 NHODES
                                                                            SUB77120
   10 BELP(J) = CZERO
                                                                           SUB77130
      DU 200 NY=1,NPY
                                                                            SÚB77140
                                                                            SUB77150
      DU 20'0: NX=1, NPX:
        DO 20 J=1,NMÓBÉS
                                                                            SUB77160
      DELP(J) = DEMP(J) +UX(NX)+UY(NY)+ANM(IC,J)
                                                                           ′SÜB′77170:
        TH(LPR.NE.OD) PR(TROW, J) = DE&P(J) *PFAC
                                                                           SUB/71800
                                                                            SU877190 -
   20 CONTINUE
                                                                            SUB/7200 -
  200 IC = 1C+1
      ** IC = NPY*NHPX+1 AT THE END OF THE NS=1 PASS
                                                                            SU877210
                                                                            SUB17220
         AND DP CONTAPNS DELTA RIG AT (XCOLL) YCULL)
C
                                                                            SUB77230
       IROW = EROW + 1:
                                                                            SUB77240
             IF (LPR.NE.0) GO TO 800
      XCOLL = XS(2,NS,IIX;IIX)
                                                                            SUB17245
                                           33
```

```
DO 400 [=1, NHODES
                                                                            SUB77250
              CALL ZDZX(I,SLOPE,DISP)
                                                                            SUB77260
              DO 401 J=1.NHODES
                                                                            SUR77270
  489 GFORC(1.J.NS) = GFORC(1.J.NS) +QNFORC*DISP*DELP(J)*2.0
                                                                            SUB17280
  800
           CONTINUE
                                                                            SUB/7290
  900
          CONTINUE
                                                                           ~SU977300
        NICX = NCICX
                                                                            58877310
        NPX = NCPX
                                                                            SUB77320
        101 = 10-1
                                                                            SUB7733a
        OFFORE = UNI + DRCX
                                                                            SUB 7.734U
 1000
        CONTINUE
                                                                            SUB/7350
      RETURN
                                                                            SUB/7360
      END
                                                                            SUB77370
       FORTRAN NESTOU, DECK
                                                                            SUB77380
$
       INCODE IBHE
                                                                            SUB77390
CKOUT
            KOUI
                                                                            SUB/7400
      SUBROUTINE KOUTCINDS
                                                                            SUB77410
      COMPLEX A.AA.ANH.CZERO.GFURC.DELP.WASH.APR.DWASH.CWASH.PR
                                                                            SUB7742U
      DIHENSION CARDS(25,502
      DIHENSION GEORG(10,10,3), DELP(10), WASH(10)
                                                                            SUB70370
      DIMENSION DWASH(90,10), PR(90,10), GWASH(90,10)
                                                                            SUB/7440
      DIMENSION SURF (2,3), XPR (50)
                                                                            SUB77450
      COMMON/C1/A(60), AA(50,60), ANM(50g10), CZERU
                                                                            SUB77460
      COHMON/C2/CLFn,Sn,NfY,NHCX,HCCX,NHPX,NCFX,HKER(20),ZKER(20);NGSKRNSUB77470
      CUMMON/C3/HPY,SUUND,NHACH;FMACH(6);MFREu;FREQ(10);MAUG;MIONCX;RHO`SUB77480
      COMMON/C4/NMODES.CCOLL, LPRWSH, LPRCO.NOM(5), ITY, ITX, NSURF, ISOLAT
                                                                            SUB77490
      COMMON/C5/FW,FC,NCOLS,AOMIT,ALPHA(10),It(50),HCOR(6),ZCCR(6),MACH SUB77500
      CUMMON/C6/kxc4n(11),WeCn(11),WeIn(11),WI(90),xCOLL,YCOLL,PI,U
                                                                            SUB77510
      CUMMON/C7/CO(10,28,2),NZCG(10,2),EM,EK,H2,NWIX,NCIX,WBO,CBON,NWCY
                                                                            SUB77520
      CUMMON/C8/IFR, XE(5), YE(3), UX(10), UY(10), WXIAN(11), E1, E2
                                                                            SUB775300
      CUHMON/C9/SIX(40,2),SCX(10,2),Y(11),ETA(11),OHY,OHWX,OHCX,CXMN
                                                                            SUB77540
      CUMHON/CPR/APP(90,60), IMOD, IROW
                                                                            SUB77550
      EUULVALENCE GSFORC,AA),(A,WASH);(WASH;DFLP)
                                                                            SUB77560
      EUUIVALENCE cuwash(1,1),APR(1,51),),(PR(1,1)&APR(1,11)))
                                                                            SUB77570
      FUULVALENCE (CHASH(1,10,APR(1,41))
                                                                            SUB77580
      EQUITAL'ENCE
                    (XPR, IL)
                                                                            SUB77590°
      DATA (SURF(1,1), I=1,39/6HHING
                                         ,8HTAIL
                                                                            SU877600
      GU 10 (10,20,30,40,50,60,70,80,90), IND
                                                                            SU877610
                                                                            SUB77620
   10 \text{ XY} = \text{XE}(5) + \text{XE}(4)
                                                                            SUB77630
      xx = xe(3) - xe(2)
                                                                            SUB77640.
      An 宇 2.0元XE(3)のYE(3) - XE(2)*(YE(3)-YE(2))
                                                                            SUB/7650
      ÅT ≅ 240+XV#YE@3)
                                                                            SUB 17660
      WRIGE(6,11)EM, SOUND, RHO, XE(1), XE(4), XE(3), XV, YE(2), YE(3), YE(3),
                                                                            SUB77670
     1YE(3),XX,XV,Aw.AT,NWCY,NIY,NWCX,NCCX,NWIX,NCIX,NPY,NPY,NWPX,NCPX
                                                                            SUB77680
   14 FORMAT(1H1///// 31X,41HHAC/NAA MISSILE SUBSONIC AIRLOADS PROGRAM
                                                                            SUB77690
     1 ///37x,30HLITGHT CONDITIONS AND GEUMETRY/1HO//15x, 13HMACH NUMBERSUB/7700
     2 =018.5,4%,16H$PEED OF SOUND =E10.3,4H L/T,4%,4HRHO=,E14.8//1HO/
                                                                            SUB/7710
     X54X,4HWING,18X,
                                                                            SUB/7720
     3 4HTAIL///22x,16HL.E. STATION (L),2F22.3//22x,16HROOT CHORD
                                                                        ベ年5/SUB77730
                                      (L),2F22.3//22X;16HT.E. SPAN
     4 2F22.3// 22X, 16HL. SPAN
                                                                        (L) SUB 77740
     5 2F22.3// 22X,16HIIP CHORD
                                      (L),2F22.5//22X,16HTOTAL AREA (L*L) SUB7775U
    46 2F22.3//22X,16HSPAN COLL. STA.,119,122,//22X,16HCHORD COLL. STA.SUB77760
     7 119,122//22X,16HCHORD INIG. STA., 119,122//22X,16HSPAN PRES MODESSUB77770
     8.119.122//22X.16HCHORD PRES MODES, 119, 1229
                                                                            SUB77780
      IF (FMACH (MACH).LF.0.95) GO TU 15
                                                                            SUB77790
      WRT1E(6,14)
                                                                            ŞUB77800
                    A MACH NUMBER GREATER THAN 0.95 HAS BEEN USED-----
   14 FURMAT(92H
                                                                          --SUB/7810
     THISE CAUTION IN APPLYING CASE RESULTS)
                                                                            SUB77820
   15 IF(NOMIT.EQ.O) RETURN
                                                                            SUB 7783 u
```

```
4RITE(6,12)(NOH(I), I=1, NOHIT)
  12 FORMAT(1HU: 15x, 51HTHE SPANNISE COLLUCATION STATION(S) OHITTED OH WSUB7F850
     11NG,915)
                                                                              SUB77860
      RETURN
                                                                              SUB77870
                                                                              SIIB77881
   20 HCX = NHCX
                                                                              SU877890
      MIX = MWIX
                                                                              SUB7790U
      DU 150 NS=1,2
                                                                              SUB77910
      9R1TE(6,22)(SURF 61, NS), 1=1,2)
                                                                              SUB77920
  22 FURHAT (191, 31x, 42HHISSILE SUBSONIC AIRLUADS PROGRAM (CONT-D)/1H / SUB/793U
     1 25x,39HCULLOCATION STATION COORDINATES ON THE 2A6/1H0,12H
                                                                         S STSUB7794U
     2A ÑO,7X,2HYC.8X,7X,11HXC VALUES--)
                                                                              SUB77950
      DU 123, IY=1.NIY
                                                                              SUB77960
      YC = NBO*SN*Y(IY)
                                                                              SUR77970
      NU 120 IX=1.NCX
                                                                              SUB/7980
 120 \text{ XPR}(IX) = Hb0*XS(1,NS,IX,IY)
                                                                              SUB77990
 123 WHITE(6,124) IY, YC, (XPR(IX), IX=1, NCX)
                                                                              SUB7800.0
 124 FURHAT(1H0,112,5E17.6/(1H ,29X,4E17.6))
                                                                              SUB/8010
      #RITE(6,105) (SURF(1,NS),1=1,2)
                                                                              SuB 78029
 105 FURMAT(1HU,24x,39HINTEGRATION STATION COORDINATES ON THE 2A6/1HO,
                                                                              SU878030
     112H
             S STA NO.7x, 2HYI, 8x, 7x, 11HXI VALUES --- )
                                                                              SUB78040
      DU 106 1Y=1, NIY
                                                                              SUB78050
      YI = WBU*SN*FTA(IY)
                                                                              SUB/8060 °
      DU 126 IX=1,NIX
                                                                              SUB/8070
 126 XPR(IX) = WBO*XS(2, NS, CX, IY)
                                                                              SUB/8080
 106 WKITE(6,124) TY, YI, (XPR(IX), IX=1, NIX)
                                                                              SUB78090
      NCX = NCCX
                                                                              SUB78108
      NIX = NCIX
                                                                              SU878110
 150 CONTINUE
                                                                              SUB/18120
      RETURN
                                                                              SUB/8130-
                                                                              SUB78140
   30 \text{ NO } 34 \text{ NS} = 1.2
                                                                              SU878150
      WKITE(6,21) | REQUIER), NMODES, EK, EN
                                                                              SUB/8160
   21 FURMAT:(1H1:31X,42HHISSILE SUBSONIC AIRLUADS PROGRAM (CONT-D)//1H /SUB/8170
     1 9X,27HOSCILLATORY FREQUENCY (CPS),F12.5,13X,12,17H DEFLECTION MODSUB78180
     2ES/1HU,8X,30HRFDUCED FREQUENCY (SEMI CHORD),F9.5,14X,23HFREE STREASUB/8190
     3M MACH NUMBER, F9.3/1H )
                                                                              SUB78200
      WKITE(6,31) TMOD
                                                                              SUB78210
   31 FURMAT(34X,34HPRESSURE COEFFICIENTS FOR MODE NO.13//19X,1H111X,10HSUB78220
     1R CUEFF(I)12x,10H1 COEFF(I) 9x,9HSPAN MODE 3x,10HCHORD MODE.)
                                                                              SUB/8236
      HRITE(6,32)(SURF(KI,NS),KJ=1,2)
                                                                              SUB/8240
   32 FORMAT(1H0,9X,2A6//)
                                                                              SUB78250
      60 10(2,3) NS
                                                                              SUB78260
     NL = NWPX
                                                                              SUB/8270
      ML = NPY
                                                                              SU878280
      iK = 1
                                                                              SUB/8290
      GU TO 4.
                                                                              SUB/8300
    3 NL = NCPX
                                                                              SUB/8310
      ML = NPÝ
                                                                              Su8/832u
      IK = NWBX*NPY+1
                                                                              SU878330
     006 \text{ IM} = 1.\text{ML}
                                                                              SUB7834u
      00 6 IN = 1, NI.
                                                                             SUB/8350
      WRITE(6,33) IK, ANM(IK, IMOD), IM, IN
                                                                              SUB/8360
   33 FORMAT(1H0,119,1P2E22.5,2113)
                                                                              SUB 7.837 u
    6 \text{ IK} = \text{IK} + 1
                                                                              SUB/18380
   34
      CONTINUE
                                                                              SUB/18390
      RETURN
                                                                              SUB7840.0
C
                                                                             *SU878410
                                                                              SUH7842U
   40 WRIJE(6,41)
   41 FORMAT(1H0,20x,38HERROR IN INPUT DATA (#0 TATL) REQUIRES//,21X,19H$UB7843U
     ATERMINATION OF CASE)
```

```
CALL EXIT
                                                                           SUB 78450
                                                                           SUB78460
   50 HRITE(6,51)
                                                                            SUB/8470.
   51 FURHAT/(1HO, 20x, 63HNUMBER OF COLLOCATION OR INTEGRATION STATIONS ORSUB78488
     1 PRESSURE TERMS/X21x,25HEXCEEDS ALLOWABLE WAXIMUM///35X,18HCASE ISSUB/5490
     2 IERMINATED)
                                                                            SHR78500
      CALL EXIT
                                                                           SUB78510
C
                                                            60 HRITE(6,21) FREQUIFR), NHODES, EKSEM
                                                                            SH# 78530.
      WRITE(6,101) SURF(1,NSURF)
                                                                           SIIR78540
  101 FORMAT(1H0,27x,45HINPUT MODE SHAPE POLYMONIAL COEFFICIENTS FOR JA6SUB/8550
     1//22X,62HREFERENCED TO THE SURFACE LEADING EDGE-CENTERLINE INTERSESUB78560
     2GIION //2X,4HHOUE,2UX, 7HCOEFFS.)
      DU 69 L=1, NHODES.
                                                                           SUB78580
      NTH = NZCO(L, NSURF)
                                                                           SUB/8591
      WKITE(6,66) E, (CO(L,K,NSURE), K=1,NTH)
                                                                           SUB78600
   66 FURHAT(1H0, 14, 4X, 1P7E13.4/(9X, 1P7E13.4))
                                                                           SUB78610
   69 CUNTINUE
                                                                           SI:878620
      RETURN
                                                                            SUR /86311
                                                                          TO WHITE (6,21) FREQUERRY NHODES, EK, EH
                                                                            SUB78650
      MRTIE(6,35) ALPHA(THOU)
                                                                            SUR78660
   35 FURHAT(24x,47HRMS ERRUR OF DUNNHASHES AT COLLUCATION POINTS =,1E13SUB7867U
     X.6)
                                                                            SUR78680
      WRITE(6,36) THOD
                                                                            SUB/8690
   36 FURHAT(1H0,23x,57HPRESSURES AND UPWASHES AT COLLOCATION PUINTS FORSUB78700
     X HODE NU.13)
                                                                            SUB78710
      WRITE(6,32)(SHRF(L, NSURF), L=1,2)
                                                                            SUB78720
                                                                           SUB/8730
      WRITE(6,37)
   37 FURHA[(]HU,/X;1HX;8X;1HY,9X;8HR P(X;Y);5X;8HI, P(X;Y),6X;
                                                                            SUB/8740
     1 9HR CW(X,Y),4X;9HI CW(X,Y),6X;9HR BW(X,Y),4X;9HI DW(X,Y))
                                                                            SUB78750
      RETURN
                                                                            SUB78760
C
                                                                           •SUB78770°
   BO WKITE(6,21) FREO(TER), NHUDES, EK, EM
                                                                            SUB78780°
                                                                            SUB78790
       WHITE (6,61) (SURF:(L, NSURF), L=1,2)
   61 FURMAT(35%,23HGENERALIZED FORCES FOR 2AA/1HO,6%,4HDEFL,3%,4HLOAD,1SUB78800
     10x,9HREAL PART,10x,9HIMAG PART,10x,9HABS VALUE,10x,11HPHASE ANGLE/SUB/881U
      2/1
                                                                            SUB78820
                                                                            SUB78830
      no /8 I=1, NHONES
                                                                            SUB/8840
       no 78 J=1,NMODFS:
                                                                            SUB7885.0
       JF(NSURF. EQ. 3) GO TO 76
                                                                            SUR78860
       G1 = REAL(GFORČ(1,J,NSURF))
                                                                            SUB78870
       G2 = AIMAG(GFORC(L,J,NSURF))
                                                                            SUB78880
      GU 10 77
   76 G1 = REAL(GFORC(7,J,1)) + REAL(GFORC(1,J,2))
                                                                            SUB78890
       G2 = AIMAG(GFORC(I,J,1)) + AIMAG(GFORC(I,J,2))
                                                                            SUB/8900
       KKK=2*NMODES
       NNN=2+J-1
       U*S≟NNNN
       CARDS(I, NNN)=G1
       CARDS(I, NNNN)=G2
    /7 \text{ GJ} = SQRT(G1**2+G2**2)
                                                                            SUR 7891ar
                                                                            SUB78920
       64 = 0.0
       IF (G3.NE.U.U) G4 = 57.2957795*ATAN2(G2,G1)
                                                                            SUB78930.
       WRITE(6,71) I, J, G1, G2, G3, G4
       IF (NSURF .NE. 3) GO TO 78
       IF (I .NE. NMODES) GO TO 78
       IF (J.NE. NMIDES) GO TO 78
       PUNCH 6969, ((CARDS(II,JJ),JJ=1,KKK), II=1,NMODES)
 6969 FURMAI (1P6H12.5)
    /15 FORMAT(1HU, 19, 17.2X, 1P3E19.5, OPF16.3, 4H DEG)
                                                                            SUB78950
```

	78 CONTINUE	SUB7.8960
	RETURN	SUB78970
C	******************************	#######\$Ü\$7898Ü
	90 MRITE(6,19) XCOLL, YCOLL, PR(IRON, INOD), CAASH(IRON, INOD),	SUB78990
	X DWASH(IROW, IMOD)	SUB79000
	19 FURHAT(1H0,2x,2F9.3,2x,2E13.4,2x,2E13.4,2x,2E13.4)	SUB79010
	RETURN	SUB7902Ú
	END	SUB79030

T.

## 4.1 Theoretical Derivation

When the flight speed approaches M = 1.0, the velocity potential equation can be written as

$$\phi_{yy} + \phi_{zz} = M^2 (2ik\phi_{x} + k^2\phi)$$
 (4.1.1)

which is valid if k>> M-1 . The linearized equation is applicable when the lifting surfaces are oscillating rapidly such that non-linear disturbances in the flow do not have time to accumulate.

Equation (4.1.1) is satisfied by a pulsating doublet which produces a velocity potential at (x,y,z) given by

$$\phi_{\rm D} = \frac{i \ k \ (z-\zeta)}{2 \ (x-\xi)^2} \exp \left\{ -1/2 \ ik \left[ (x-\xi) + \frac{(y-\eta)^2 + (z-\zeta)^2}{(x-\xi)} \right] \right\}$$
(4.1.2)

where the doublet is positioned at  $(\xi,\eta,\zeta)$ . The doublet has no influence at points upstream of the line  $x = \xi$  and, consequently, the potential is zero in that region.

A solution to equation (4.1.1) may be obtained by superposition. This solution will be represented in the form

$$\phi(\mathbf{x},\mathbf{y},\mathbf{z}) + \iint \phi(\xi,\eta,\phi_{\mathbf{D}}(\mathbf{x},\mathbf{y},\mathbf{z},\xi,\eta,\phi)d\xi d\eta \qquad (4.1.3)$$

where  $\phi(\xi,\eta)$  is the doublet strength of point  $(\xi,\eta)$ .

To compute the velocity potential distribution, the wing, wake and control surface is divided into a lattice of square boxes as shown in Figure 4.1.1. The potential function is replaced by a set of point values at the box centers. The potential function and downwash value is assumed constant over each box and equal to the central value.

The problem reduces to imposing boundary conditions and determining the doublet strength for each box to satisfy the boundary conditions. The boundary value problem becomes

## 1. Tangential Flow Condition

$$w(x,y)_{\text{wing}} = \iint_{\text{wing}} \phi_{-}(\xi, \eta) \lim_{z \to 0} \frac{\partial \phi_{D}}{\partial z} d\xi d\eta \qquad (4.1.4)$$

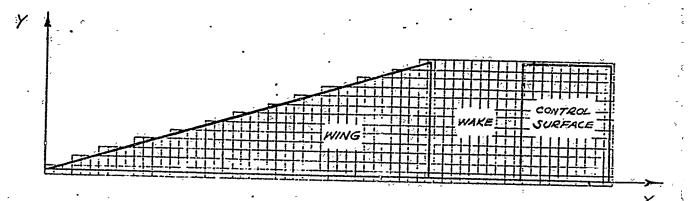


Figure 4.1.1 Sonic Box Overlay Pattern

$$w(x,y)_{\text{control}} = \iint_{\text{surface}} \phi(\xi,\eta) \lim_{z \to 0} \frac{\partial \phi_D}{\partial z} d\xi d\eta$$

$$\text{wakê} +$$

$$\text{control}$$

$$\text{surface}$$

$$(4.1.5)$$

2. Zero Přessure Jump in Wake

$$\frac{\partial \phi}{\partial x} - ik\phi = 0 \tag{4.1.6}$$

Equation (4.1.6) is an ordinary homogeneous differential equation subjected to the condition  $\phi$  is equal to the value of the velocity potential at the wing trailing edge for x = x wing t.e. This gives the solution

$$\phi_{\text{wake}} = \phi_{\text{wing t.e.}} e^{-ik(x-x_{\text{wing t.e.}})}$$
(4.1.7)

Equations (4, 1.4), and (4.1.5) and (4.1.7) form a system of equations from which the point values of the potential functions can be found at the box centers. The pressure distribution is then determined from the relationship

$$\Delta P(\mathbf{x}, \hat{\mathbf{y}}) = \frac{1}{2} \rho U^{2} (2\frac{\partial \phi}{\partial \mathbf{x}} + 2i\mathbf{k}\phi) \tag{4.1.8}$$

and the generalized forces are found from equation (2.0.1).

## 4.2 PROGRAM DESCRIPTION

The Sonic Unsteady Aerodynamics Program calculates generalized forces for up to 10 deformation modes. The computer solution is based upon the Mach box technique. The various configurations which can be analyzed are shown in Figure 4.2.1 and Table 4.2.2. The analysis includes interaction effects between tandem surfaces and wake effects on the trailing surface. Single surfaces may be analyzed by inputing a second curface with a zero chord length.

The transonic box method calculates the unsteady potentials from which the pressure distributions may be obtained for arbitrary modes of surface motion. The method used was suggested by the successes of the supersonic box methods of Pines and others, Reference 11. The potential is generated by a doublet distribution rather than by a source distribution because the latter method would involve diaphragm regions of infinite extent, whereas the doublet distribution is confined to the wing and its wake. As with the subsonic problem, the differential equation solution is an integral equation. The integral equation is approximated numerically by a matrix equation so that the basic step in the box method is the solution of the system of simultaneous equations which determine a set of values of potential on the surface from a corresponding array of upwash values. The solution procedure obtains the velocity potential over the surface one spanwise row of boxes at a time until the trailing edge row is completed. The numerical complexity is not increased, however, by a large number of box rows over the configuration because the influence coming from moré than 15 rows away has been found to be negligible. The results are valid for high reduced frequency, k, such that  $k \gg M - 1$  where M is the Mach number.

The solution for the generalized aerodynamic forces requires the input of the deformation modes due to vibration. The program considers the modes to be expressed as analytic functions of the form:

$$w(x, y) = \sum_{m=0}^{N} \sum_{m=0}^{n} C_{(n-m), s, m} x^{(n-m), m}$$

To meet this requirement only the coefficients "c" are required as input into the program. These coefficients can be obtained in several ways, the most common way is to surface fit the modes by the least-square technique.

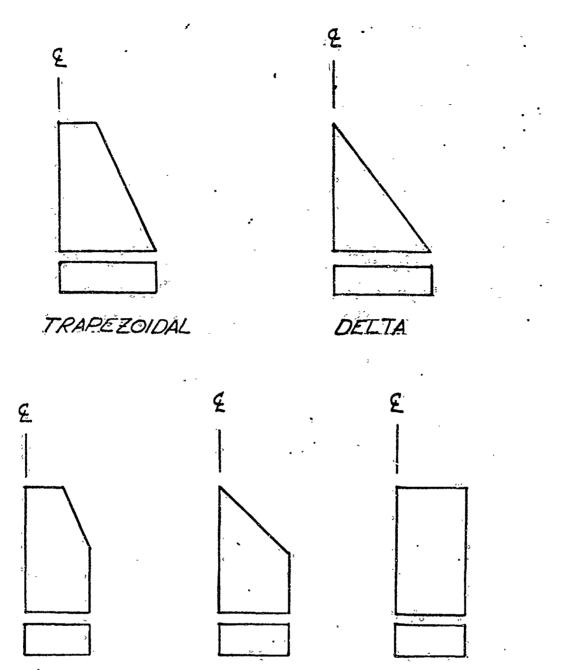


FIGURE 4.2.1 TANDEM COPLANAR CONFIGURATIONS AT SONIC MACH NUMBER

DELTA (CROPPED) RECTANGULAR

TRAPEZOIDAL (CROPPED)

TABLE 4,2.2 OPTIONAL GONFIGURATIONS

CONFIGURATION	CHORDWISE COORDINATE	SPANWISE COORDINATE
	X(1) ≈ v.0	Y(1) = 0.0
•	X(2) = 0.0	Y(2) = 0.0
RECTANGULAR	X(3) > 0.0	Y(3) > 0.0
	$X(4) \ge X(3)$	,
	X(5) ≩ X(4)	
	X(1) = 0.0	Y(1) = 0.0
-	$\mathbf{X(2)}_{>} \geq 0.0$	Y(2) = 0.0
,	X(3) = X(2)	Y(3) > 0.0
DELȚA	$X(4) \geq X(3)$	
	$X(5) \ge X(4)$	1
	$\dot{\mathbf{X}}(1) = 0.0$	Y(1) = 0.0
	X(2) > 0.0	Y(2) > 0.0
TRAPEZOIDAL	X(3) = X(2)	Y(3) > Y(2)
t	$X(4) \ge X(3)$	
	$X(5) \ge X(4)$	
	X(1) = 0.0	Y(1) = 0.0
1	X(2) > X(1)	Y(2) > 0.0
TRAPEZOIDAL (CROPPED)	X(3) > X(2)	Y(3) > Y(2)
ľ	$X(4) \ge X(3)$	
•	$X(5) \ge X(4)$	
	X(1) = 0.0	Y(1) = 0.0 :
,	X(2) > 0.0	Y(2) = 0.0
DELTA (CROPPED)	X(3) > X(2)	Y(3) > Y(2)
	$\dot{X}(4) \geq X(3)$	
•	$X(5) \ge X(4)$	

## 4.3 INPUT INSTRUCTIONS

Instructions for preparing input data for the transonic. computer program are presented here. The field location and format for each quantity is specified. Any set of units may be used for geometric dimensions and acoustic velocity as long as they are consistent, e.g., if inches is used for length, then the acoustic velocity must have dimensions of inches per second. The required data and the sequence in which the information is entered is as follows:

## 1. Streamwise Coordinates (6El2.5 format)

Çolumn	1-12	13-24	25-36	37,48	49-60	61-72
Name	X(1)	X(2)	<u>х</u> (3)	X(4)	, X (5)	
Item	(1)	<b>(2)</b> : ,	(3)/	(4)	(5)	

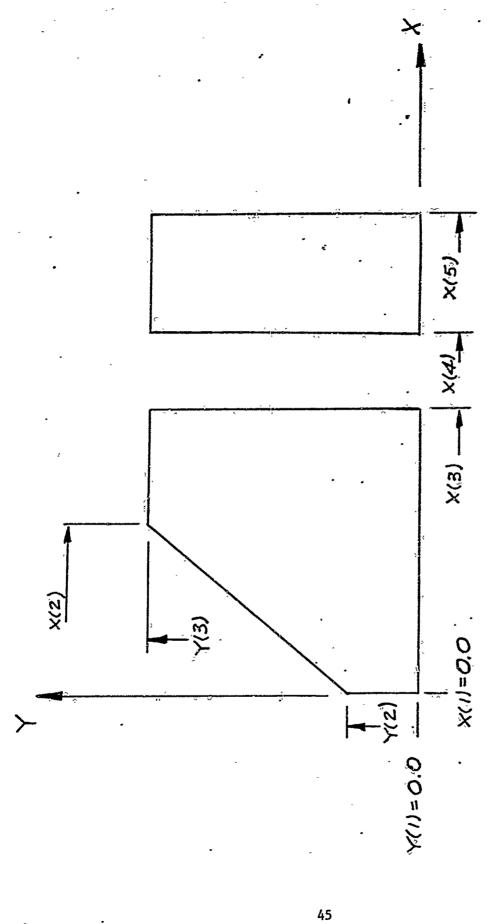
- (1) X(1) Wing root leading edge coordinate (See Figure 4.3.1)
- (2) X(2) Wing tip leading edge coordinate
- (3) X(3) Wing trailing edge coordinate
- (4) X(4) Control surface leading edge coordinate
- (5) X(5) Control surface trailing edge coordinate

A single surface, the wing, may be analyzed by setting X(4) and X(5) equal to X(3). The various configurations are generated as shown in Table 4.2.1. The origin for the planform and AIC station coordinates must be at the leading edge root of the wing, therefore X(1) and Y(1), described below, must always be zero.

2. Spanwise Coordinates and Acoustic Velocity (6E12.5 format)

•	( ~	T	· _ <u> </u>			
Column	1-12	13-24	25-36	37-48	49-60	61-72
Name	Y(1)	¥(2)	Y(3)	SOUND	RHO	
Item	(1)	(2)	(3)	(4)	<b>(5)</b>	

- (1) Y(1) Wing root spanwise coordinate
- (2) Y(2) Wing leading edge spanwise coordinate
- (3) Y(3) Wing (and control surface) tip spanwise coordinate
- (4) SOUND Speed of sound at altitude for which analysis is performed
- (5) RHO density of fluid \* 1000.0 (M./L<sup>3</sup>)



I

I

I

1

2

生

T

FIGURE 43.1 GEOMETRY DESCRIPTION

3. General Information (6112 format)

Column	1-12	13-24	25-36	37-48	49-60	61-72
Name	NMACH	NFREQ	NMODES	NBW	LVPIC	LSSVP
Item	(1)	(2)	، (3)	(4)	(5)	(6)

(1) NMÁCH

Number of Mach numbers (max 6)

(2) NFREQ

Number of input frequencies (max 10)

(3) NMØDES

Number of input modes (max. 10)

(4) NEW

Number of chordwise wing boxes (max 10)

(5) LVPIC

Print velocity potential influence coefficients; 0 ~No,

l∼Yes

(6) LSSVP

Print upwashes; 0 ~ No, 1 ~ Yes

4. Mach Numbers (6E12.5 format)

·Column	1-12	13-24	25-36	37-48	49-60	61-72
Name	FMACH(1)	FMACH(2)	FMACH(3)	FMACH(4)	FMACH(5)	FMACH(6)
'Item	(1)	. (2).	.(")	(4)	(5)	(6)

- (1) FMACH(i) Mach numbers for which the analysis is to be performed.
- 5. Frequency (6E12.5 format)

Column	1-12	.13-24	25-36	37-48	49-60.	61-72
Name	FREQ(1)	FREQ(2)	FREQ(3)	FREQ(4)	FREQ(5)	FREQ(6)
Ĭtem	(1)	(2)	(3)	(4)	(5)	(6)

(1) FREQ

Frequencies for which the analysis is to be performed. Continue on next card for FREQ(i) 6.

6. Deformation Modes. Repeat the Following Cards NMODES Times

	(6112)	Format				
Column	1-12	13-24	. 25-36	37-48	49-60	61-72
Name	NIM1(i)	NFI				
Įtem	(1)	· (2):	, î			,

(1) NTM1(i)

Number of deformation mode coefficients for the wing, mode i

(2) NFI

Compute generalize forces; 0~ No, 1~ Yes

If NFI = 0 the program will compute the VPIC's and stop.

(6E12.5). Format.

	(OEIZ.	. J). POPERA			<u> </u>	
Column	1-12	13-24	25-36	37-48	49-60	61-72
Name	CØ(1):	CØ(2)	CØ(3)	CØ(4)	CØ(5)	CØ(6)
Item	(1)	(2)	(3)	(4)	(5)	<u>(6)</u>

(1) CØ(i)

i = 1, NTM deformation polynomial coefficients to be input in the following order: 0,0; 1,0; 0,1; 2,6; 1,1; 0,2; 3,0; where the first integer is the power of "x" and the second is the power of "y". Continue on successive cards until all polynomial coefficients are input.

Column: Name Item

(6112	2) Format				
1-12	13-24	25-36	37-48	49-60	61-72
NIM	NFI			(	) 
(1)	(2)				,

(1) NIM2(1)

Number of deformation mode coefficients for the control surface, mode (i)

(2) NFI

Compute generalized forces;  $0 \sim \text{No}$ ;  $1 \sim \text{Yes}$ . If NFI = 0, the program will compute the VPIC's and stop.

Column Name Item

	(6E12	.) Format				
Ŀ	1–12	13-24	25 <b>–</b> 36 ~	37-48	49-60	
	CØ(1)	CØ(2)	ĊØ(3)	CØ(4)	CØ(5)	
1	(1)	(2)	(3)	(4)	(5)	

CØ(i)

i - 1, NTM deformation polynomial coefficients to be input in the following order: 0,0; 1,0; 0,1; 2,0; 1,1; 0,2; 3,0; etc. where the first integer is the power of "x" and the second is the power of "y". Continue on successive cards until all polynomial coefficients are input.

## 4.4 SAMPLE PROBLEM

The generalized forces are calculated for the configuration below. The flight parameters and pertinent input data are presented on the first page of the computer print out.

The coefficients of the deformation modes for the forward surface are shown on the third page of the computer print out, and for the aft surface on the fifth page of the computer print out.

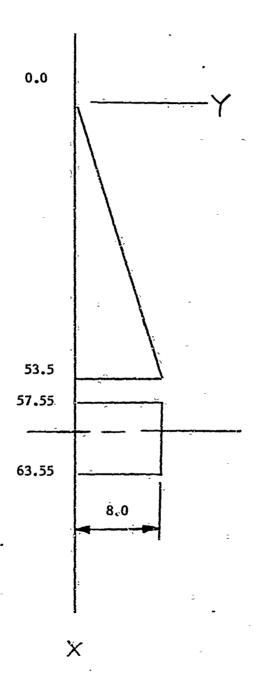


FIGURE 4.4.1

# HACZNAA MISSILE TRANSONIC AIRLÓATS PROGRAM

I

0.00

1000

## FLIGHT CONDITIONS AND RECOMETRY

H.E. STATION (L)  ROOT CHORD (L)  L.E. SPAN (L)  T.E. SPAN (L)  T.E. SPAN (L)  T.E. SPAN (L)  T.E. SPAN (L)  B.000  6.000  TIP CHORD (L)  TOTAL AREA (L*L)  CHORDWISE BOXES  SPANWISE GOXES  7  7  7  7  7  7  7  7  7  7  7  7  7	Σ :	MACH. NUMBER	1,00000	SPEED CF	SPEED OF SOUND = 13392.000 L/T	RHO=0.11460000E-06
L.E. STATION (L)  ROOT CHORD (L)  L.E. SPAN (L)  T.E. SPAN (L)  TIP CHORD (L)  TOTAL AREA (L+L)  CHORDWISE BOXES  SPANWISE BOXES  7  7  57.550  6.000  6.000  77  77	-	•			CRIM	TAIL
ROOT CHORD (L)       6.000         L.E. SPAN (L)       8.000         T.E. SPAN (L)       6.000         TIP CHORD (L)       0.         TOTAL AREA (L+L)       428.000         CHORDWISE BOXES       5         SPANWISE BOXES       7	-	ů	STATION (L)		**************************************	57,550
L.E. SPAN (L) 0, 8,000 T.E. SPAN (L) 8,000 TIP CHORD (L) 0, 6,000 TOTAL AREA (L*L) 458,000 CHORDWISE BOXES 5		ROOT	CHORD (L)		53,500	000. 9.
T.E. SPAN (L)  TIP CHORD (L)  TOTAL AREA (L+L)  CHORDWISE BOXES  SPANWISE BOXES  7		<u>.</u>			, Ö.	
TIP CHORD (L)  TOTAL AREA (L+L)  CHORDWISE BOXES  SPANWISE BOXES  7	÷	<b>⊢</b>			000*8	8.000
TOTAL AREA (L+L) CHORDWISE BOXES 49 SPANWISE BOXES 7	-	). dI1	_		÷	000 * 9
CHORDWISE BOXES		TOTAL	L AREA (L+L)		428,000	96.000
SPANNISE		CHOR				'n
	:	SPAN				

BOX SPAN # 1.20225E, 00 L

BOX CHORD = 4.202256 00 L

TOTAL CHORDWISE BOXES X 53

# MISSILE TRANSONIC AIRLOADS PROGRAH (CONTID)

```
HAP OF SOWIC BUX OVERLAY

ON WING, TAIL AND HAKE

(S) - WING

(S) - TAIL

S
```

.

# MISSILE TRANSONIC AIRLOADS PROGRAM (CONT.D)

Carrier O

	a ORA		110.0000			MOKID DIRE	- -
	REDUCED FREGUENCY	NCY (SEM! CHO	RD) 1.38055		FREE STREAM M	ACH NUMBER	1.000
-	<b>α</b>	INPUT MO EFERENCÉD <sub>T</sub> O	DE SHAPE PCLY THE SURFACE L	NOMÍÁL COEFFI EADING EDGE-C	CIENTS FOR WI	NG ERSEC <sub>T</sub> ION	
MODE		COBFFS,			-		-
ਜ	6.2231E-01 -5.7624E-02 -9.2425E-02	4,96476E=03 7,9094E=01 4,4647E=07	2.17146 00 -2.51256 00 -2.73386-05	-1.1796E=02 -4.5847E=05 4.4296E=04	1,1765E-01 2,4591E-03 -2,5737E-03	-2.3426E 00 -3.5940E 02 7.8341E 03	1.3893E-03 1.4666E-01
N .	8.94945-04 -3.0455E-L4 -1.9612E-03	1,94724E-03 1,0010E-03 1,0017E-09	-1.5229 E-02 -1.81065 -02 -1.6695E-07	1.3060E-04 -5.8051E-08 2.2909E-06	1,4047E-03 1,4540E-03 11,3876E-05	2,5887E-02 -1,7126E-04 -3,8650E-05	1,77148-06 1,5541E-08 2,1062E-04
ာ	12.0277E-03 1.5004E-03 2.2924E-02	*1,8600E=03 *1,7053E=01	-4.0090E+01 5.3718E+01 6.6433E+06	2.8498E+03 1.0358E+03 -9.9828E+03	#5.0835E102 #6.0834E104 9.9923E104	5.2506E-01 7.9228E-03 -1.9292E-03	14.2004m+04.24.24.24.24.24.24.24.24.24.24.24.24.24
ंक्र	6.8155E-03 2.7715E-03 1.9833E-02	*6,2155E-03 *1,81654E-01	-1.0847E 00 3.2703E-01 3.0791E-06	2,4746E=03 7,1336E=04 -6,1616E=05	9,3898m:02 3,4012m:04	4.8655E-01 5.1428E-03 -8.7292E-04	1.2.4.4.2.0 日
ம்	2,2147E-03 #3,3292E-03 #3,9610E-03	9-1-420 8-8-8-0 8-0-9-5-0 8-0-9-5-0 8-0-9-9-9-9-9-9-9-9-9-9-9-9-9-9-9-9-9-9-	11.8393E103 11.3252E101 14.3987E104	-6.5138E+04 -2.1796E+04 2.1637E+05	1,7097E-02 1,3006E-04 -1,2205E-04	38.4463E-02 3.2906E-04	6:8574 7:4420 80:00 80:00 80:00 80:00 80:00
	-						

## HISSILE TRANSOVIC AIRLOADS PROGRAM (CONT'D)

OSCIELA	OSCILLATOŘY FREDUÉNCY (CPS)	ENCY (CPS) 1		53 BOXES IN CHORD DIRECTION	DIRECTION
REDUCED	FREQUENCY	REDUCED FREQUENCY (SEMI CHORD)	1,38055	FREE STREAM HACH NUMBER	NUMBER 1.000
		ĐNĐŮ	GENERALIZEC FORCES FOR WING	5%1 x	
DEFL LO	רַסְלְּטֵּי.	REAL PART	PHAG, PART	ABS VALUE	PHASE ANGLE
<b>-</b> 1	Ħ	3,16858E 02	-1,37658E 02	3,45469E 02	-23.482 DEG
<b>-</b>	٠,	-5,52591E-01	2.66777E 00	2,72440E 00	101.70% DEG
	* m	-5,62,170E 01	Z.07533E C1	5.992548 01	159.738 DEG
<b>+</b> 1	•	-8,10722È 30	3.26216E 01	3,361398 01	103.957 DEG
	·W	1:16660E 01	-6.65916E 00	1,34328E 01	-20,719 DEG
~	• •	*2,44726E 00	2.26683E 00	3.332246 00	137.133 DEG
~	~	8,84216E-01	-2.39821E-01	9,161676-01	-15.175 DEG
.د.	ņ	*5,69430E 00	2.64395E 00	6.27818E 00	155.094 DEG
c <sub>2</sub>	4	*1,55191E 00'	-2.19162E 00	2,68545E.00	-125.303 DEG
· ~	·ίν	2,87546E-01	-2.500065-02	2,88631E-01	-4.969 DEG
m	्या	-6,65830E: 01	2,523978 01	7,12063E 01;	159,240 DEG
ьÿ	٠.	•7,0496îE 0ù	-1.50816E 00	7.20919E 00	-167.923 DEG.
12	'n	7,38453E 01	-1.35683E 01	7,50815E 01	-10.411 DEG
cî:	*	27915146 01	1.99798E 01	3,53412E 01	34:426 DEG
₩.	, N	-7,90C48E 00,	-2.34443E-01	7,90395E AD	-178.300 DEG
_	÷н	1,59553E 01	2,36006E 01	2.84879E 01	55.939 DEG.
_	· ·	-2,71097E.00	3.88001È.00	4.73326E 00	134.942 DEG
	m`	3,77.450E 00	-3.69283E 01	3,71207E 01	-64.164 DEG
•	•	-2,14405E 01	-1.64663E 01	2,70339E 01	-142.476 pEG
÷	r.	2,90952E 00	5.23504E 00	6.02850E 00.	60.271. DEG
10	₩.	6,76158E 00	-7.51507E 00	1.01092E 01	-48.021 DEG
ري د	ಌ	5,48742E-01	-3.20824E-01	6.35646E-01	-40.313 DEG
ស		*4,27173E 00	4,958846 00	6.34506E 00	236:743 DEG
10	₩.	4,30316E .00	2.14755E 00.	4.80928E 00	26.522 DEG
z.		1,87838E-01	-9, 02,441E-01	9,21782E-01	-78,242 DEG

# MISSILE TRANSONIC AIRLOADS PROGRAM (CONT.D)

COMPACT.

Tables,

A SECTION OF

Exchasts Baconers

Contract !

The state of the s

N.	1,000			-3,9767E-03	1,2913E+03 1,6180E+03	4,0742E-03	9,8326E-05	14.9446 14.046 10.02 10.03 10.03
CHORD DIRECTION	MACH NUMBER	IL ERSECTION		-6.3951E-03	-2 - 02 E 02 E 02 - 5 - 4809 E 04	-1,2620E-03 -6,0549E-07	7.4449E-04 -2.1877E-05	-1.8510E-02 5.2220E-05
SĂ BOXES IN C	FREE STREAM M	TCIENTS FOR TAIL		2,2663E-03	-2,6948E-02 -2,7508E-04	*1,4954E-03	-2,3306E-04 1,5745E-05	5-0903E-03
•	•	YNOMIAL COEFFI LEADING EDGE-C		2,53796-02 1,92526-04	*1.7451E-02 3.1356E+05	-1,6733E-02 -3,1325E-04	-1.1390E-03 1.6233E-07	8,4246E+02 1,3989E+03
110.00000	(D) 1.38055	SHAPE PCL		2.0342E-02 1.1172E-03	-8.3996E-02	-8.5200E-03 2.8296E-04	-4.9131E-03 -2.4853E-04	2.4793E=02 3.4434E=03
EQUENCY (CPS)	NCY (SEMI CHORD	INPUT MODE REFERENCED TO THE	COEFFS.	3,6669E-02 9,8702E-04	8,2139E-02 1,6668E-03	4,90865-02 2,78975≂04	8,2141E-03 -3,0224E-06	1,15199E-01 4,2392E-05
ÓSCILLATORY FREQUENCY (CPS.)	REDUCED FREGUENCY (SEMI	œ		-1.0091E 00 -2.0287E-03 -6.7077E-05	-1.2752E-01 7.7354E-03 -1.0213E-04	-8,3787E-02 1,5179E-05 -1,9476E-05	-7.2257E-03 1.7613E-05 1.7159E-05	#5.8014E-01 #9.6255E-05 -2.0522E-04
			MODË	स	N	∕w -	4	ທ .

## MISSILE TRANSONIC AIRLOADS PROGRAM (CONT'D)

DEFI   Load   Real Part   Libbre   Free Street   Libbre	OSC 1	OSCILLATÓRY FREQUENCY (CPS).	ENCY (CPS)	110.00000	53/80XES IN CHORD DIRECTION	1100
LOAD  REAL PART  HAG PART  HAG PART  1.1641066 02  2.1720576 02  1.1720576 02  1.1720576 02  1.1720576 02  1.1720576 02  1.1720576 02  1.1720576 02  1.1720576 02  1.1720576 02  2.1720136 02  2.1720136 02  2.1720136 02  2.1720136 02  2.1720136 02  2.1720136 02  2.1720136 02  2.1720136 02  2.1720136 02  2.1720136 02  2.1720136 02  2.1720136 02  2.1720136 02  2.1720136 02  2.1720136 01  2.1720136 02  2.1720136 02  2.1720136 02  2.1720136 02  2.1720136 02  2.1720136 03  2.17201	REDU	JOED FREQUENCY	(SENI CHORD		FREE STREAM MACH NUMBER	1,000
LOAD         REAL PART         INAG PART         ABS VALUE           1         3,20570E         02         -1.64136E         02           2         1,78757E         07         -1.64136E         02         2.35104E           3         1,35618E         02         -6.59142E         01         1.59437E         02           4         1,40846E         02         -6.59142E         01         1.55437E         02           5         1,03474E         03         -7.16951E         01         1.55437E         02           6         1,165340E         02         -6.59142E         01         1.55437E         02           7         1,165340E         02         -6.59142E         01         1.55437E         02           8         1,24734E         02         -6.90346E         01         1.55396E         01         1.55437E         02           9         646705E         01         -1.55396E         01         1.26459E         02         -6.51462E         01         1.54399E         02           1         1,17462E         01         -7.2546E         01         -7.2499E         01         1.41673E         01           2			ΞÎ		TAIL	
1 3,20570E 02 -1.64130E 02 3,60133E 02 2 1,78751E 07 -1.52739E 02 2,35104E 02 1,35618E 02 -2.12913E 01 1,39101E 02 1,0374E 02 -2.12913E 01 1,39101E 02 1,0374E 02 -6.59142E 01 1,39101E 02 1,14794E 02 -6.59142E 01 1,39101E 02 1,47794E 02 -6.5913E 01 1,39101E 02 2 1,24794E 02 -6.5913E 01 1,39101E 02 2 8,75103E 01 -1.55398E 01 1,36035E 02 2 1,46453E 01 -2.23677E 01 1,02045E 01 2 1,44434E 01 -2.23677E 01 1,24990E 01 1 1,29545E 00 -1.09465E 01 1,24990E 01 1 1,29545E 00 -4.67734E 00 2,46476E 00 2 8,481309E 01 -2.50313E 00 1,41673E 01 2 1,24591E 01 -2.50313E 00 1,41676E 01 2 1,24676E 01 -2.50313E 00 1,38173E 01 2 1,71697E 01 -1.28912E 00 2,46476E 00 2 1,71697E 01 -1.28912E 01 1,79044E 02 2 1,71697E 01 -1.28912E 01 1,79044E 02 2 1,71697E 01 -1.28912E 01 1,79044E 02 2 1,71697E 01 -1.28912E 01 1,7904E 01 2 1,71697E 01 -1.28912E 01 1,7904E 01 2 1,71697E 01 -1.28912E 01 1,7904E 01 2 1,79051E 02 -1.28912E 01 1,7904E 01 2 1,79051E 02 -1.28912E 01 1,79051E 01	DEFL	LOAD	REAL PART	IHAG PART	ABS VALUE	PHASE ANGLE
2 1,78757E 07 -1.52799 02 2,35104E 07 3 1,35618E 02 -2.12013E 01 1,30101E 02 4 1,40816E 02 -6.5142E 01 1,55437E 02 1 1,6540E 02 -6.5142E 01 1,03722E 03 1 1,6540E 02 -6.5142E 01 1,03722E 03 2 1,03474E 03 -7.16951E 01 1,03722E 03 3 6,75103E 01 -1.5539E 01 1,02065E 02 4 9,66705E 01 -3.2747E 01 1,02065E 02 5 9,66906E 02 -6.51462E 00 5,97032E 02 1 1,12434E 01 -2.23677E 01 2,5261E 01 2 1,64673E 00 -1.09465E 01 1,10696E 01 2 1,64673E 01 -6.32983E 00 1,24990E 01 2 1,24434E 01 -6.32983E 00 1,24990E 01 2 1,24434E 01 -6.72983E 00 1,41673E 01 2 2,56365E 00 -1.20912E 00 2,64076E 00 2 8,44320E-01 -2.50315E 00 2,64076E 00 2 1,74697E 01 -7.84607E 00 1,79084E 02 2 1,5338E 02 -1.64599E 02 2,03545E 02 2 1,5467E 01 -7.84607E 00 1,79084E 02 2 2,56365E 00 -1.28912E 00 1,79084E 02 2 3,43739E 02 -1.49139E 01 3,43812E 01 4 3,43739E 02 -1.49139E 01 3,43812E 01 5 11,74697E 01 -3.42119E 01 3,43812E 01 5 11,29038E 02 -3.42119E 01 3,43812E 01	ਜੰ	· 🕶		-1.64136E		-27.109 DEG
3         1,35618E 02         -3,12913E 01         1,39481E 02           4         1,40816E 02         -6,59142E 01         1,55437E 02           5         1,03474E 03         -7,16951E 01         1,55336E 02           1         1,65340E 02         -6,59142E 01         1,5533E 02           2         1,24794E 02         -6,42609E 01         1,65336E 02           3         6,75103E 01         -1,5539E 01         1,63393E 02           4         9,66705E 01         -1,5539E 01         1,02765E 02           5         5,9696E 02         6,51462E 00         5,9703E 02           1         1,17132E 01         -2,2307E 01         1,16463E 02           2         1,64673E 01         -6,7730E 02         5,9703E 02           3         1,10777E 01         -6,7730E 02         1,44673E 01           4         1,24434E 01         -6,7730E 02         1,44673E 01           5         6,18177E 01         -6,7730E 02         1,44673E 01           6         6,13276E 01         -1,28241E 00         2,64076E 01           7         1,29545E 02         -1,28241E 00         2,64076E 02           8         1,7467E 01         -1,28912E 02         2,03546E 02           1         1	**	٧.	1,787578 02	-1.52739E		-41.507 DEG
4 1,40816E 02 -6.59142E 01 1,55437E 02 1 1,03474E 03 -7.16951E 01 1,03722E 03 1 1,6540E 02 -6.90346E 01 1,03734E 02 2 1,24794E 02 -6.42639E 01 1,65393E 02 3 6,75103E 01 -1.55396E 01 1,02065E 02 4 9,66705E 01 -3.27417E 01 1,02065E 02 5,96996E 02 6.51462E 00 5.97032E 02 1 1,17162E 01 -2.23677E 01 2,52681E 01 2 1,64673E 00 -1.09465E 01 1,24990E 01 3 1,24434E 01 -6.32083E 00 1,41673E 00 2 8,48177E 01 -6.32083E 00 1,41673E 01 1 1,29545E 01 -6.57336E 00 2,68417E 00 2 8,44320E-01 -2.50315E 00 2,68417E 00 2 1,78091E 02 -1.280412E 00 3,32013E 00 2 1,78091E 02 -1.64959E 02 2,03542E 01 3 -2.08674E 00 -3.42119E 01 3,43842E 01 4 3,43775E 01 -3.42119E 01 3,43842E 01 5 11,29388E 02 -3.42119E 01 5,89521E 02		n		-3.12913E		-12.993 DEG
5 1,03474E 03 -7.16951E 01 1,03722E 03 1 1,65340E 02 -8,90348E 01 1,87316E 02 2 1,24794E 02 -6,42639E 01 1,86393E 02 3 6,75103E 01 -1.55398E 01 1,86393E 01 4 9,66705E 01 -2,23677E 01 1,02665E 02 5 96996E 02 6,51462E 01 2,52641E 01 1 1,17462E 01 -2,23677E 01 2,52641E 01 2 1,64673E 01 -2,23677E 01 2,52641E 01 3 1,24434E 01 -6,72308E 00 1,44673E 01 1 1,29545E 00 -4,67704E 00 2,6447E 00 2 8,43775E 01 -2,26241E 00 2,6444E 00 1,74697E 01 -2,56315E 00 3,32013E 00 2 1,74697E 02 -1,28913E 00 3,32013E 00 2 3,43775E 01 -2,64956E 02 1,79044E 02 2 1,78991E 02 -1,64996E 02 1,79044E 02 3 4,3775E 01 -3,4214E 01 3,43842E 01 4 3,43775E 00 -3,42149E 01 3,43842E 01 5 1,28038E 02 -5,72696E 02 5,87251E 02	-	•				-25,080 DEG
1 1,65340E 02 -E.90348E 01 1,85394E 02 2 1,24794E 02 -5.42639E 01 1,56393E 02 3 8,75103E 01 -1.55398E 01 1,02065E 02 4 9,66705E 01 -3.27417E 01 1,02065E 02 1 1,17162E 01 -2.23677E 01 2,5264EE 01 2 1,64673E 00 -1.09465E 01 1,10696E 01 2 1,64673E 00 -1.09465E 01 1,10696E 01 3 1,07777E 01 -6.3293E 00 1,24990E 01 1 1,24349E 01 -6.3293E 00 1,24990E 01 1 1,29545E 00 -4.67734E 00 2,64076E 00 2 8,4320E-01 -2.56315E 00 2,64076E 00 2 8,44320E-01 -2.56315E 00 2,64076E 00 2 8,44320E-01 -2.56315E 00 2,64076E 00 2 8,44320E-01 -1.28912E 00 2,64076E 00 1,74697E 01 -7.884607E 00 1,786775E 01 2 -1.78991E 02 -1.61959E 02 2,03545E 02 2 -1.78991E 02 -3.4219E 01 3,43842E 01 4 3,43775E 00 -3.4219E 01 3,43842E 01 5 11,29338E 02 -5.72898E 02 5,63551E 02	<b>~</b>	ľ		-7.16951E		-3.964 DEG
2 1,24794E 02 -5,42639E 01 1,56393E 02 3 6,75103E 01 -1,55398E 01 1,02065E 02 4 9,66705E 01 -3,27417E 01 1,02065E 02 5,96996E 02 6,51462E 00 5,97032E 02 1 1,17462E 01 -2,23677E 01 2,52641E 01 2 1,64673E 00 -1,09465E 01 1,10696E 01 4 1,24434E 01 -6,77338E 00 1,24990E 01 1 1,29545E 00 -4,67734E 00 1,24673E 00 2 6,64076E 00 -4,67734E 00 2,64076E 00 2 6,64076E 00 -1,28041E 00 2,64076E 00 4 3,05965E 00 -1,28041E 00 2,64076E 00 2 1,71697E 01 -7,84607E 00 1,88775E 01 1 1,29545E 01 -7,84607E 00 1,88775E 01 2 2,58367E 02 -1,64959E 02 1,88775E 01 2 2,58367E 02 -1,64959E 02 1,78094E 02 3 1,71697E 01 -7,84607E 00 1,79084E 02 4 3,43775E 00 -3,4219E 01 3,43842E 01 5 1,29038E 02 -5,72898E 02 5,8755E 01	8	п		-8.80348É		-28.033 DEG
3 8,75103E 01 -1.55308E 01 6,88793E 01 4 9,66705E 01 -3.27417E 01 1,02065E 02 5,96696E 02 6.51462E 00 5.97032E 02 1 1,17162E 01 -2.23677E 01 2,82661E 01 2 1,66673E 00 -1.09465E 01 1,10696E 01 3 1,0777E 01 -6.32983E 00 1,24990E 01 1 1,29636E 01 -6.77338E 00 1,24990E 01 1 1,29945E 00 -4.67734E 00 2,64076E 00 2 1,41673E 00 -4.67734E 00 2,64076E 01 3 2,58365E 00 -1.28641E 00 2,8441E 00 2 1,71697E 01 -7.84607E 00 1,79084E 02 2 1,71697E 01 -7.84607E 00 1,79084E 02 3 -2.08674E 00 -3.4219E 01 3,43842E 01 4 3,43775E 00 -3.4219E 01 3,43842E 01 5 1,29038E 02 -5.72898E 02 5,78364E 02 5,89537E 01	8	çږ		-9.42639E		-37.068 DEG
4 9,66705E 01 -3.27417E 01 1.02065E 02 5,96996E 02 6.51462E 00 5,97032E 02 1,64673E 01 -2.23677E 01 2.52661E 01 2 1,64673E 01 -6.32963E 00 1.24990E 01 1,24434E 01 -6.32963E 00 1.24990E 01 1 1.29545E 01 -4.11626E 01 1.24990E 01 1 1.29545E 00 -4.67734E 00 2.64076E 00 2 8,447320E 01 -2.56315E 00 2.64076E 00 3 2,58365E 00 -1.28241E 00 2.64076E 00 4 3,05965E 00 -1.28041E 00 3,32013E 00 1,71697E 01 -7.84607E 00 1.79084E 02 2 2,03545E 01 -5.84507E 01 3,43842E 01 4 3,43775E 00 -3.42119E 01 5,8951E 01 5 11,29038E 02 -5.72899E 02 5,68751E 02	8	m				-10:069' DEG
5       5,96696E 02       6.51462E 00       5,97032E 02         1       1,17462E 01       -2.23677E 01       2,52681E 01         2       1,64673E 00       -1.09465E 01       1,10696E 01         3       1,0777E 01       -6.32963E 00       1,24990E 01         4       1,24434E 01       -6.77308E 00       1,41673E 01         5       8,16177E 01       -4.11626E 01       1,41673E 01         1       1,29545E 00       -4.67734E 00       4.85313E 00         2       8,43320E-01       -2.5635E 00       2,64076E 00         4       3,05965E 00       -1.28041E 00       2,6447E 00         5       1,71697E 01       -7.84607E 00       3,32013E 00         6       1,7697E 02       -1.28042E 00       1,79084E 02         7       -2,8304E 01       -3,43042E 01       -3,43042E 01         8       -2,08674E 00       -3,4219E 02       -5,72896E 02	8	4				-18.711 DEG
1 1,17,162E 01 -2.23577E 01 2.52661E 01 2 1,64673E 00 -1.09465E 01 1.10696E 01 3 1,0777E 01 -6.32963E 00 1.24990E 01 4 1,24434E 01 -6.7236E 00 1.41673E 01 1 1,299545E 00 -4.67734E 00 4.653,13E 00 2 68,41320E-01 -2.56315E 00 2.64076E 00 3 2,58365E 00 -1.28241E 00 2.64076E 00 4 3,09965E 00 -1.28942E 00 3,32013E 00 1,74697E 02 -1.64959E 02 2.03545E 02 2 -1.78991E 02 -1.64959E 02 2.03545E 01 4 3,43775E 00 -3.42119E 01 3,43842E 01 5 1,29038E 02 -5.72898E 02 5.89521E 02	~	ń				o.625 pEG
2 1,66673E 00 -1.09465E 01 1.10696E 01  3 1,2434E 01 -6.72983E 00 1.41673E 01  4 1,24434E 01 -6.77308E 00 1.41673E 01  1 1,29545E 00 -4.67734E 00 2.64076E 01  2 8,41320E-01 -2.50315E 00 2.64076E 00  4 3,05955E 00 -1.28241E 00 2.64076E 00  4 3,05955E 00 -1.28241E 00 2.64076E 00  5 1,71697E 01 -7.84607E 00 3,32013E 00  1 2,43338F 02 -1.61959E 02 2.03545E 02  2 2,03545E 01 -3.42119E 01 3,43842E 01  4 3,43775E 00 -5.89137E 01 3,43842E 01  5 11,29038E 02 -5.72896E 02 3,551E 02	ю	Ħ				-67.376 DEG
3       1,07777E 01       -6.32983E 00       1,24990E 01         4       1,24434E 01       -6.77350E 00       1,41673E 01         5       8,18177E 01       -4.11626E 01       9,15887E 01         2       8,44320E 01       -2.50315E 00       2,64076E 00         3       2,58365E 00       -1.28241E 00       2,64076E 00         4       3,09965E 00       -1.28912E 00       3,32013E 00         5       1,74697E 01       -7.84607E 00       3,32013E 00         2       -1,28912E 00       1,7897E 02       -1,41959E 02         2       -1,78991E 02       -1,41959E 02       2,03545E 02         3       -2,08674E 00       -5,89137E 01       5,89537E 01         4       3,43775E 01       -5,89137E 01       3,43842E 01         5       1,29038E 02       -5,72898E 02       5,87251E 02	n	8				-81.445 DEC
4 1,24434E 01 -6,77338E 00 1,41673E 01 5 8,18177E 01 -4,11626E'01 9,15887E 01 1 1,29545E 00 -4,67734E 00 4,85313E 00 2 8,41320E-01 -2,50315E 00 2,64076E 00 3 2,58365E 00 -1,28241E 00 2,86441E 00 4 3,09965E 00 -1,28912E 00 3,32013E 00 5 1,71697E 01 -7,84607E 00 1,88775E 01 1	ю	n		-6.32983E		-38.426 DEG
5 8,1817E 01 -4,11626E 01 9,15867E 01 2 8,44320E-01 -2,50315E 00 4,85313E 00 2,56365E 00 -1,28241E 00 2,64076E 00 4 3,05965E 00 -1,28241E 00 3,32013E 00 5 1,71697E 01 -7,84607E 00 1,88775E 01 1 \$\tilde{\text{v}}\tex	ю	•				-28.540 DEG
1 1.29545E 00 -4.6774E 00 4.85335E 00 2 8/41320E-01 -2.50315E 00 2.64076E 00 3 105965E 00 -1.28241E 00 2.66441E 00 4 3.05965E 00 -1.28912E 00 3.32013E 00 5 1.71697E 01 -7.84607E 00 1.88775E 01 1 *1.2387E 02 -1.61959E 02 2.03545E 02 2 *1.78991E 02 5.89137E 01 5.89507E 01 4 3.43775E 00 -3.42119E 01 3.43842E 01 5 1.29038E 02 -5.72898E 02 5.87251E 02	ю	ហ		-4.11626E-01		-26,707 DEG
2 8644320E-01 -2.56315E 00 2.64076E 00 3 2,56365E 00 -1.28241E 00 2.63441E 00 4 3,05965E 00 -1.28912E 00 3,32013E 00 1,71697E 01 -7.84607E 00 1,88775E 01 2 2,03545E 02 -1.41959E 02 2.03545E 02 2 2,03674E 00 -5.89137E 01 5,89597E 01 4 3,43775E 00 -3.42119E 01 3,43842E 01 5 1,29038E 02 -5.72898E 02 5,87251E 02	•	Ħ			4,85313E 00	-74.518 DEG
3 2,58365E 00 -1.28241E 00 2,88044jE 00  4 3,05965E 00 -1.28912E 00 3,32013E 00  5 1,71697E 01 -7.84607E 00 1,88775E 01  1	*	8	8 41320E-01	-2.50315E 00		-71.422 DEG
4 3.05965E 00 -1.28912E 00 3.32013E 00  1 1.71697E 01 -7.84607E 00 1.88775E 01  2 2.1,73287E 02 -1.61959E 02 2.03545E 02  2 2.08674E 00 -5.89137E 01 5.89597E 01  4 3.43775E 00 -3.42119E 01 3.43842E 01  5 1.29038E 02 -5.72898E 02 5.87251E 02	4	ю			2,88441E 00	-26.398 DEG
5 1,71697E 01 -7.84607E.00. 1,88775E 01 1	•	4		-1.28912E		-22.847 pEG
1	*	ın				-24.559 DEG
2 *1,78991E:02 5.78304E 00 1,79084E.02 3 *2,08674E 00 -5,89137E 01 5.89507E 01 4, 3,43775E 00 -3,42119E 01 3,43842E 01 5 1,29038E 02 -5,72898E.02 5,87251E 02	ιÀ	ਜ		-1.61959E	05	127.279 DEG
3 -2,08674E 00 -5,89137E 01, 5,89507E 01 4, 3,43775E 00 -3,42119E 01 3,43842E 01 5 1,29038E 02 -5,72898E 02 5,87251E 02	rv,	N	#1,78991E :02			178.149 DEG
3,43775F 00 -3,42119E 01 3,43842E 01 1,29038E 02 -5,72898E 02 5,87251E 02	în	-		-5.89137E		-92.029 DEG
1,29038E 02 -5,72898E 02 5,87251E 02	Ŋ	र्ष		-3.42119E		-84%262°DEG
	ĸ	ស		-5.72898E		-77,307 DEG

## MISSILE TRANSONIC AIRLOADS PROGRAM (CONT'D)

The state of the s

CHARLES OF THE PARTY OF THE PAR

A Charles

Charles S

53 BOXES IN CHORD DIRECTION	FREE STREAM MACH NUMBER 1,000	GENERALIZED FORCES FOR WING + TAIL
OSCILLATORY FREQUENCY (CPS) 110.00000	REDÜÇED FREGUEKCY (SEMI CHÜRD): 1,38055	GENERALIZED FOR

## 4.5 PROGRAM LISTING

```
FORÍBAN NESTOU, DECK
$
                                                                                  SON7003U
crsis
             CSTS
                                                                                  S0N70050
       BLOCK DATA
                                                                                  SUN/0060
       COMPLEX CZERO, PAÍ, PRIME, DPHI, SPRI
                                                                                  SUN70U7U
       COMMON/C3/CU(10.25,2),N1(10.2),NF(1U.2),NTMAX(2),FN(28),DXE(6),TP[SUN70080
      COMMON/C7/CZFRO, PUL, PHI (E, DPHI, SPHI)
                                                                                  SUN70190°
       CUMPON/C8/RPG
                                                                                  S0N70100
       NATA CZERU/(0.0,0.0)/, TPI/6.2831853/, FN/0.,1.,0.,2.,2.,1.,0.,3.,2.,
                                                                                  SON/9110
      1 1 . . 0 . . 4 . . 3 . . 2 . , 1 . . 1 . . 5 . . 4 . . 3 . . 2 . . 1 . . 0 . . . 6 . . 5 . . 4 . . 3 . . 2 . . 1 . . 0 . /
                                                                                  S0N7.012U
                                                                                  SUN/U13U
       FORTRAR NESTOU, D.Ck
                                                                                  SON/U14u
CHAIN
             MAIR
                                                                                  SUN70160
       COMPLEX VP10, NS, Da, O, PHIW, CK, CŽEŘO, PHI, PHITE, DPHI, ŠPHI, ASU, EXF
                                                                                  SUN70170
       DIMENSIUN ASO(49,40)
                                                                                  SON/018U
      在DMF 09/1/K: 0x(2000),XE(5),YE(3),AR(3),X1,X2,X3,X4,Y1,Y2,8ETA,NBS S0N70190
       COMPONICZ/AS. MAGILEMACH(6), NEREQ. FREQ(10), NMODE, NSURF, LVPIC, LSSYPSONIO200
       CUMS-CN/C3/C-(c10,20,2),NT(10,2);NF(10,2),NTMAX(2),FN(28),DXE(6),IPISON/0210
       rung (m/C4/VF)C(mu,15), 05(200), DQ(28,2),Q(10,10,3), PHIN(50), CK(40)SON/6460
       COMMON/C5/HOB(100), hBL(100), FC
                                            , IFR, XL, NS, NIM, K, J, QR, GI, QAB, QAN SUN/0230
       COPPONIZED AZONO DE LA CONTRETA DE C
       COME US/C7/C7FRO, Pal, Palle, DPHL, SPHI
                                                                                  SUN70250
       C0MF047187RF0
                                                                                  SUN/G26U
                                                                                  S0N79270
     T CALL BALD
                                                                                  SGN7U28U
       BU 4000 MACHEL, MACH
       PH = { bACh( ACH)
                                                                                  SON/0290
       IF(ARS(EH-1.0) GIT.0.05) GO TÖ 1000
                                                                                  SUN70300
       CALL CODE
                                                                                  SUN70310
       CALL POUT(1)
                                                                                  SQN/0320
      TPH=TP1/(AS*F 1)
                                                                                  SUN7033U
       RFH = HX
                                                                                  SUN70340
       HG 900 IFR =1.NFRI-D
                                                                                  SUN/0350
       EK=FREO(IER)*1PH
                                                                                  S0N/0369
       F (| K. E. O. U. P.) Got 10 900
                                                                                  SUN7 037 0
       FRF =FK*KF;
                                                                                  SON7-0380
       FKP = FK+X1/2:6
                                                                                  SUN/0390
       CALL POT2H
                                                                                  S0N70400
       TECTIVELENE OF CALL POUT (2)
                                                                                  SUN7 041 0
       A'KG=FK*IIX
                                                                                  S0N7U42U
       EXF = CMPLX (CUSCARG), -SIN(ARG))
                                                                                  SUN/0430
                                                                                  S0N70440
       NO 500 MODE=1,NAOOE
                                                                                  S0N70450
       no 16 J=1,50
                                                                                  SON/8468
   In BU(J.1)=CZERO
       (F (BF (MODE, 1). Fo. o) GO 70 210
                                                                                  SUN/0470
       X=0.5+0X
                                                                                  S0N/0480
                                                                                  Š0N70490
       NH=1
       IF (ESSYPORFOR) SALL PUBLICS)
                                                                                  SON/0500
       AD 200 NP=1. NEOX
                                                                                  SON70510
       (4W)804=64
                                                                                  SON/0520
                                                                                  SUN/II530
       0 = 0
       KODE = KBOX(Hec)
                                                                                  SUN/0540
       NS =1
                                                                                 S0N/0550
       60 10 (12,11,12,11,11,120), NOVE
                                                                                  S0N70560
   11 NS =2
                                                                                  SUN/0570
   12 00 20 MP=1, B
                                                                                 SUN/0580
       SPEL = CZERO
                                                                                 SUN/UGOD
       IF (MP.GT.1) CAN, PHIR
                                                                                 SUN70610
       CALL MASH
                                                                                 SUN/0620
       CK(NP)=05(Nn)
                                                                                 SUNXU63U
       BS(nk) = nS(nk) - SPHI
                                                                                 SUN/0640
       Y = Y+1:Y
                                                                                 `SUN70650
```

```
20 \text{ KB} = \text{NB+1}
     8M-9N = 8N
     90 30 IU=1, PB
     no 30 Ju=1; mb
     1J0 = IABS(10-Ji) \cdot 1
 25 ASO(10, JQ) = VP(C(1JQ, 1)
     IF (JQ.Fu.1) go in 3n
     | JG=| D+JU-1
    CI, DLI) DIAA+(Of '01) 654±(Of''01) 054
 SH CHNITAUE
     ISO = MSIMER((40, Mo; 1, ASO; DS(NB))
     IF (150.F0.4) 30 TO 39
     CALL POUT(8)
    -GO 10 900
 39 COMPLANF
     Y = 0.0
     TE (hP. NE.1) Gu 10-50
     NO 45 MR=1, "R
 45 NS(NP) = US(MP) *2, 173.1415927
 SO CONTINUE
     1F (KODE-NE.4) 50 TO 80
     NU 60 MP=1,FR
     OS(EB) = PHI4(MP)+(FS(NB)-PHIH(HP))*2.0%3.1415927
 00 NB=#R+1
    HH-HM=HH
 84 CONTINUE
     00 100 MP=1,44
     IF (KODE.EU.3) PHIH(MP)=US(NB).*EXE
     IF (LP.FO.NBOX-1) "HIH(NP)=DS(NB)
     PHTAF = DS(PA)
     IF(MP.FO.NBOX) PHITE = PHITE+(PHITE-PHIW(HP))*DXE(5)
    PHT = DS(NB)
     IF(ISSVP.NE.O) CALL POH1(4)
    CALL DOLD
    NH = NH + 1
lun y=y+ny
    60 10 200
120 DU 130 NP=1, MR
    DS(rB)=PHIH(MP)
    PHIK(MP) = EXE*PHIW(MP)
    CK(PP)=CZLRI
    If (ISSVP+4E.B) GATE PUBL(4)
150 \text{ NB} = \text{NB+1}
2011 X = X+11X
210 DU 400 MU =3.0MOVE
    NO 300 NS=1, NSURF
    Ř(MODE,MO,NS)=CZERO
    NTH=NT(MO,NS)
    NO 300 W=1, 14
3UA G(MODE, XU, NS)=Q(MBDE, MO, NS)+CU(MO, N, NS)*DQ(N, NS)
    G(MDF \cdot MO \cdot 3) = GZ5RO
400 Q(FODE, MO, 3)=0(460F, MO, 1)+Q(MODE, MO, 2)
SUR CONTINUE
    00 800 NS=1,3
    CALE POUT(6)
    80 700 J=1,cMnp+
    00 700 K=1, MADE
    QR = FTG*REAL(J(代,J,NS))
    QI = FG*AIMrG(O(k,J,NS))
    CAP=SURI(UI *O [+ 1K*Oko)
```

đị.

SUN7066U

S0N7U67U

SUN70680

SUN7069U

SUN/U700

SUN70710

S0N70720

S0N70730

SON/0740>

SUN70750

SUN70760

รยห7บัวฺ7บ

SUN70780.

SUN/6790

SUN/Û80U'

SON70810.

S0N/0838

SÛN70840

SUN/085U.

SUN70860

Sun7987.0

SUN AU 880

SUN70890

S0N7U900

SUN/0910

SUN7:0920

SON/0940

SUN70950

S0N7U960:

SUN/0970

S0N70980

SUNJOY9U

SUN71U1U

SUN/1020

S0N/1030

.ŠUN/10*4*°0

S0N/1070

S0N71080

S0N71190

SON/1100

SUN71110

SUN71120 -

SUN/1130

SUN/1140

SON71150

SUN/1160

S0N/1170

SUN/1180

S0N71190

SUN71200

SUN/1210

SON/1220

SUN/1230

SON/1240

SON/1250

S0N71260

SUN/1270

SUN71060 a

SUN/1000.

<sup>-</sup>Sบห78820

```
SON71280
                                                                                SUN/1299
      1F (GAB.NE.0.0) GAN=57.29578*ATAN2(QI,QR)
      CALL POUT(7)
                                                                                S0N7130U
      PF(BSURF.EQ.1) 60 TO
                                                                                S0N71310
  800 COMPINUE
                                                                                SON71320
  900 CUPTINUE
                                                                                SON71330
 JUAN COMITARE
                                                                                SUN/1348
      go To i:
                                                                                SON71350
      FND
                                                                                SOM/1360
       FORTRAN NUSTOU, DECK
                                                                                SURFLATE
CHAIN
             DAII
                                                                                SON/1390
      SURKOUTINE PAIN
                                                                                SON/1400
      COMMON/C1/K+0x(2000), xE(5), YE(3), AR(3), X1, X2, X3, X4, Y1, Y2, BETA, NBS SON71410
      COMPON/C2/AS, MACH, MACH(G), NFREQ, FREQ (10), MMODE, NSURF; LYPIC, USSYPSON/1420
      CUMPOR/C3/C1-(10,24,2), NT(10,2), NF(10,2), NTHAX(2), FN(28), DXE(6), TPISON/1430
      COMMON/C6/X,Y,Dx,UY,FA;EK,EKB;EKR,NP,FP,NB;HBOX,KODE,MODE,NBW,NBT SON/1440
      COMEON/C8/RIO
                                                                               SUN71450
      READ(5,11) (XE(1),I=1,5)
                                                                               SON71460
      RFAD(5,11) (YE(1), J=1,3), AS, RHO
                                                                                SUN/1470
      R40 = P40/1404. (
                                                                               SUN/1480
      REAL(5,12) WARC OFFERO, NAUDE, NAW, EVPIC, LSSVP
                                                                               SUN/1490
      SEAD(5,41) (FNAGH(1), F=1, NMÀCH)
                                                                                SUN/15UU
      REAP(5, P1) (FRE ((1), 1=1, NFREQ)
                                                                                SUN/1510
      RSHFF=2
                                                                                SUN71520
      1f()f(4).LT.Xf(54) G9 TO 10
                                                                                S0N/1530
      NSURF =1
                                                                                SON71540
      XF (4)=XL (3)
                                                                                S0N71550
      XI (5)=XE(3)
                                                                                S0N71560
   Tu NTHAX(1.)=0
                                                                                S0N71574
      NIMAX(2)=0
                                                                                SON7.1580
      po 30 MUDE=1, am ape
                                                                                SON/1590
      DO SO I=1, NSURF
                                                                                SON71600
      10 20 J=1,21
                                                                                S0N71/610
   20 CO(MODF, J. 1) = 0.4
                                                                                S0N/1020
      READ(5,12) IM, OF I
                                                                                S0N71630
      AT CHOOF, I) => TM
                                                                               SUN/1640
      NIMAX(I)=MAXO(NIMAX(I),NTM)
                                                                                SUN71650
      MF (MODE, 1) = FI
                                                                                S0N71668
   30 READ(5,11) (CO(400E,J,I),J=1,NTM)
                                                                                S0N71670
   11 FORMAT(6E12.8)
                                                                                SUN71680
   12 FORMA! (6112)
                                                                                SUN71690
      RETURN
                                                                                SUN71700
      FND
                                                                                SON71710
       FOLTRAG NESTAULOSCK
                                                                                SUN71720
CCCDE
             CODE
                                                                                SON71740
      SUBSTOUT PAR LODE
                                                                                SUN71750
      COMMON/C1/KL0x(2000),XF(5),YF(3),AR(3),X1,X2,X3,X4,Y1,,Y2,BETA,NBS SON7176U
      COMMON/C2/ASaUMAChalMACH(6).NFREQ.FREQ(10).NMODE.NSURF.LVPIC.LSSVPSON/1770
      COMMON/C3/C:(10,28,27,NI(10,2),NF(10,2),NTMAX(2),FN(28),DXE(6),TP1SON/1780
      COMMON/C5/MCB(A 0B), RBL(10B), FU
                                           , IFR, XL, NS, NTM, K, J, QR, UI, QAB, UAN SON71790
      COMMON/C6/X,Y,Dx,DY,EM,EK,EKB,FKR,NP,MP,NB,NBOX,KODE,MODE,NBW,NBI SÕN7180Q
      COMPONY 687 REA
                                                                                S0N71810
      BFTA = EM
                                                                               S0N71820
      \chi_{\perp} = \chi_{\perp}(3) - \chi_{\perp}(1)
                                                                                SUN/1830
      X2 = XF(3) - (E(2))
                                                                                SUN71840
      x3 = xE(4) - xF(1)
                                                                                SON71850
      x4 = xF(5) - xF(4)
                                                                                S0N71860
      x_5 = x_6(5) - x_6(1)
                                                                                SUN/1870
      YI = YE(2) - YE(1)
                                                                                SON/1880
```

SUN71890-

Y2 = YF(3) - YF(1)

```
IF(X2.GT-X1.OR.X1.G1.X3.OR.X3.G1.X5.OR.X22LT.Q.U) GO 10 50
                                                                                    SUN71900
       IF(Y1.GT.Y2.OR.Y1.LT.U.Q) GO TO 50
                                                                                    SUN71910
       THI = 0.0
                                                                                   SUN71920
       IF (Y2.NE.Y1)
                       T_{ML} = (X1 - X2) / (Y2 - Y1)
                                                                                   S0N7193U
       AR(1) =
                       (Y2*(X2+X1) ~ Y1 * (X2-X1))
                                                                                   SUN71940
      AR(2) = Y2 * x4 * 2 \cdot 0.
                                                                                   SUN7.1950
       $P(3) = $R@) + AR(2)
                                                                                   SUN/1960
   IN DX = X1/(FE, AF(ABH) -0.5)
                                                                                   SUN71970
       IF (190.0* 1:X .ST. X5) GO TO 20
                                                                                   SUN/1980
   15 \text{ NBW} = \text{NBW-1}
                                                                                   SUN/1990
      0f q1 00
                                                                                   S0N72000
   20 nr = DX/Beta
                                                                                   S0N72010
       YU1 = Y1/DY
                                                                                   S0N7.2020
       YN2 = Y2/NY
                                                                                   S0N72030
       XNI = YN2 - (x1-x2) / DX
                                                                                   SUN/2049
       XN1 = YN2 + X5/nX
                                                                                   SUN72050
       XNIF = X3/DX
                                                                                   SUN72060
       XNTF
                = X5/0X
                                                                                   S0N72070
                        + 9.5
       MROX = XNTE
                                                                                   S0N72080
       NKS = Y2/DY + 1.0
                                                                                   S0N72090
       RRT = X4/UX → 0.5
                                                                                   SUN/2100
      . \, \mathsf{D} \mathsf{XF} (1^\circ) \; = \; \mathbf{1} \boldsymbol{.} \, \mathsf{e}
                                                                                   SUN72110
       DXF(2) = 1.0
                                                                                   SUN72120
       月XF(3)"= 0.5
                                                                                   SUN7213U
       DXF(4) = Al' I(XMLE + 1.5) - XMLE
                                                                                   SUN72140
       DXF(5) = XNIF
                          - [LUAT(NBGX-1)
                                                                                   S0N72150
       D \times F(6) = 0.4
                                                                                   S0N72160
       X = 0.5 * Dx
                                                                                   S0N7217U
       NB = 0
                                                                                   SON72180
      KUDE = 1
                                                                                   S0472198
      DO 40 NP = 1,480X
                                                                                   SUN/2200
      XN = FLGAT(PP) - 0.5
                                                                                   S0N/2210
       YH = YH?
                                                                                   SUN72220
       IF (THL .GT. u.u) Yk=AMIN1((Yh,YN1+XN/(THL/BETA))
                                                                                   S0N72230
      MH = TFIX(Y*)+1
                                                                                   SUN72240
   28 JEUP (NP) = M:-
                                                                                   SUN72250
       IF (MB.G.I.40) 00 for 15
                                                                                   SUN72260
       IL (NP JEW, NHW) KOHE =3
                                                                                   S0N72270
          (NSURF .FQ.1) GO TO 29
(X .GT. x1) EOOE ≈6
                                                                                   SUN72280
                                                                                   SUN72290
          (X .GT. X3
                         ) KUBE =4
                                                                                   SON/2300
          (X .6[. X3+Dx) KODE=2
                                                                                   S0N72310
          (NP .EQ. NOOX) KODE =5
                                                                                   SUN/2320
   29 [F(AB+MB+GT.2000) GO TO 15
                                                                                   S0N723311
      ABI (NP) = No
                                                                                   SON72340
      0.030 \text{ MP} = 1.48
                                                                                   SUN/2350
      NB = NB +. 1
                                                                                   SUN/2360
   SA KBOX (NB
                   ) = 人(の)F
                                                                                   S0N72370
   411 X = X+'DX
                                                                                   S0N72388
       QOPHO = 0.5*(AS*E4)**2
                                                                                   S0N72399
      FO = -6·食*DX*BY*OORFO/FM*RHU
                                                                                   S0N7240U
       RETURN
                                                                                   SUN/2410
   50 CALL EXPI
                                                                                   S0N72420
       ŘETURN
                                                                                   SUN72430
      END
                                                                                   SUN72440
       FORTRAW NESTOU, DECK
                                                                                   SUN72450
CPGT2H
             P012H
                                                                                   S0N72470
       SUBROUTINE FOIR
                                                                                   SUN/2480
      COPPLEX VPPC, uS-Du, u, PHIW, CK, CÉX
      ĆUMMON/C4/VFIC(30,15),DS(2000),DQ(28,2),Q(10,10,3),PHIN(50),CK(40)SON7646U
```

```
COMMON/C5/MOR(100), PRE(100), Fu
                                       JIFR, XL, NS, NTH, K, J, QR, QT, QAB, QAN SON72510
   COMMON/C6/X,Y,DX,BY,EH,EK,EKB,EKR,NP,PP,NB,NBOX,KODE,HODE,NBW,NBT SON/2520
   COMMONICATED
                                                                            SON72538
   W=5*HOB(NBOX)
                                                                            SUN72540
   N=HINO(NBOX,15)
                                                                            $9N72556
   UK=FKB
                                                                            S0N72560
   DK2=DK##2
                                                                            S0N72570
   ¥1=K-1
                                                                            SUN72580
   IIK8=DKS/8.0
                                                                            S0N7259U
   DK4=2.0+DK8
                                                                            SUN72600
   NK12=NK2/12.0
                                                                            SUN72610
   CH=0.5
                                                                            SÚN72620
   DH=DK=0.5
                                                                            S0N72630
   DH=0.5*DH
                                                                           SUN/2640
   DH=2.0*BK-
                                                                           SUN7265U
   ากโห≃กก
                                                                           SUN72660
   D1=0.25*DF2
                                                                           SUN12670
   85=6K2/24.0
                                                                           S0N7268U
   BG 3 %=13H
                                                                           SUN/2690
   91=0.0
                                                                           SON/27.00
   84=2.0/1M
                                                                           SON72710
   82=85/k4-UH
                                                                           SUN/2720
   83=40.5=85
                                                                           SUN72730
   na=31H±84+85
                                                                           SUN/2740
   N4≅IK8#E4
                                                                           S0N7:2750
   111:4=2:0 +114
                                                                           S0N72760
   CN=1.0
                                                                           SUN72770
   ն3≙ր.ս
                                                                           SON/2780
   C4=8.0
                                                                           SUN/2790
   C/=0.0
                                                                           SON/2800
   CB=0.0
                                                                           S0N7281.0
   NO-2 J=1,N
                                                                           S0N7282U
   Al=PM/Ch
                                                                           SUN/2830
   C1=CM# COS(41)
                                                                           SUN/2840
   C2=-CM* SIN(AN)
                                                                           SUN72850
   CALL CSIN(A1, C5, C6)
                                                                           SUN72860
   C5=CM+C5
                                                                           SUN72870
   C6==CH+C6
                                                                           SON72880
   09=01-03
                                                                           SUN7289U
   C10=C2-C4
                                                                           S0N72900
   C11=C5-C7
                                                                           SUN/2910
   C12=C6-C8
                                                                           S0N72920
   VRF=63*C9-B4*C1U-H5*C3-R1,*C11-B2*C12
                                                                           SON72930
   VLM=B4*C9+B3*31#-85*C4+B2*C11-B1*C12
                                                                           SON/2940
   VPIC(I,J)=CMPLX(VRE,VIM)
                                                                           S0N72950
                                                                           SON7296Ú
23 C3=61
                                                                           รอท729ั7ม
   C4=C2
   C7=C5
                                                                           S0N72980
                                                                           SUN7299U
   C8=C6
   R1=91-b1
                                                                           SON/3000
  B3=B3-B3
                                                                           SUN73010
   R4=F4-D4
                                                                           SUN/3020
   D4=04+004
                                                                           SUN/3830-
   CN=(.N+2.0
                                                                           SUN73040
 2 CUNITAUL
                                                                           SUN73650
   CM=CM+1.0
                                                                           S0N73060
   MUH+MU+MUH
                                                                           Ŝun73u7u
 3: DDM=DUM+DD
                                                                           SUN73080
   00 5 J=10 N
                                                                           S0N/3090
   DO 4 1=1,M1
                                                                           SON/3100
```

```
SUN73110
          K=H-I
                                                                                   SUN73120
          VPIC(K+1,J)=YPIC(K+1,J)-VPIC(K,J)
                                                                                   SON73130
           VPIC(1,J)=2.0 = VFIC(1,J)
                                                                                   SUN73140
           CH=0.0
                                                                                   SUN/3150
           กห=์แ.0
                                                                                   S0N73160
           DDH=DK
           DO 12 I=1,8
                                                                                   S0N73170
           C7=U.U
                                                                                   SON/3180
           C8=0.0
                                                                                   SUN/3190
                                                                                   SUN73200
           C9=11.U.
           C10=0.0
                                                                                   SON73210
                                                                                   SUN/3720
           P1=#.0
           P2=0.0
                                                                                   SUN73230
                                                                                   SUN/3240
           CN=1.0
                                                                                   S0N7325U
           86=ú.5*ilk12
                                                                                   S0N73260
           Du 10 J=1,N
                                                                                   SON/327U
           A1=CH/CN
                                                                                   Suk73280
           A2=UM/CN
                                                                                   SUN73290
           if (A1-0.2) 7,7,8
                                                                                   SUN73300
         7 日1=2。ロー入1*#2/3。リ
           82=-BK/(6.0*CH);
                                                                                   SON/3310
                                                                                   SUN73320
           60 10 9
                                                                                   SUN73338
         8. HJ = SIN(A2)/A1
           R1=2.0*83
                                                                                   SON/3340
           R2=(B3- CUS(A1))/42-DH/CN+B3
                                                                                   SON/3358
                                                                                   SUN/3360
         9 83= COS(A2)/Ch
           B4= SIN(A2)/CN
                                                                                   SUN73370
           C3=1:1:#83+82=84
                                                                                   SUN/3384
           C4=H2 #B3-B1¥B4
                                                                                    SON/3390
                                                                                    SUN/3480
           B5=UH*CN
           C1=15*C4-2.#*C3
                                                                                    SUN/3410
           C2=-24.0 * C4+1 5 * C3
                                                                                    S0N73420
                                                                                    SUN73430
           C5=(1-C7
                                                                                    SUN73440
           C6=C2-C8
           P3=P2-R6#CN
                                                                                    S0N73450
                                                                                   S0N73468
           P4=F3+2.0*Ur12*(C:-1.0)
                                                                                    SUN73470
           VRF=C5-P1*Cn+P3*Cn-P4*Cy
           VIM=C6+P1*C5+P3*C4~P4*C10
                                                                                    SUN/3480
           VPJC(1,J) = VPIC(1, I) + CMPEX(VRE, VIH)
                                                                                   SUN73490
           P1=P1+DH
                                                                                    SUN73500
           P2=P2+CH*DK4
                                                                                    SON73510
           CN=[N+2.U
                                                                                   S0N73520
           C7=C1
                                                                                   SUN73530
                                                                                    SON7"540
           C8=C2
                                                                                    SUN73550
           09=03
           C1#=C4
                                                                                    SUN7356U
           R6=B6+DK12
                                                                                    S0N7357u
        IN CONTINUE
                                                                                    S0N7358U
           CM=CM+DK
                                                                                    SUN 23590
           DM=I;M+DaM
                                                                                    S0N7360#
        12 DIM=DOM+DD
                                                                                    S0N73610
           D3=1K/(2.0*a.44159265)
                                                                                    S0N7362U
                                                                                    S0N73630
できた
                                                                                    SUN73640
           DO 14 J=1 2N
           CEX=D3*CMPLY(SI*(A1), COS(A1))
                                                                                    SON7-3,650
                                                                                    SUN73660
           DO 13.1=1,M
        13 VESC(I, J)=CEX*VEIC(I, J)
                                                                                    S0N73670
                                                                                    SON73680.
        14 A1=A1+DH
                                                                                    SON73690
           ŘETURN
                                                                                    S0N73700
                                                    61
```

```
FORTRAN NESTOU DECK
                                                                               S0N73710
CCSIN
             CSIN
                                                                                S0N7373U
      SURFOUTINE CSIN(X1,U,S)
                                                                                S0N7374U
ſ,
      SIME AND COSINE INTEGRAL SUBROULINE
                                                                                SON73750
                                                                                SON/3760
£.
      C AND S ARE THE INTEGRALS OVER 1 FROM 1 TO INFINITY OF
                                                                                S0N73770
ľ
           COS(XT)/T AND SIN(XT)/T
                                                                                S9N/378U
ſ
                                                                                S0873740
      SG=1.0
                                                                                S0M7380 @
      x = y_1
                                                                                SUN73810
       IF (X) 1,2,2
                                                                               S0N73820
    1 SG = -SG
                                                                                SUN73830
      X = -- }
                                                                               SON/3846
    2 X2=X=X
                                                                                S0N73850
      IF (X-1.0) 3,5,4
                                                                               S0N73860
C
                                                                               SON7387U
1
      FOR ARS(X) LESS THAL I A SERIES EXPANSION IS USED
                                                                               SUN73880
                                                                               S0N/389U
    f v=(((x2/98.u-u.6)*.u5*X2+1.0)*X2/18.0-1.0)*x41.657079633
                                                                               S0N73900
      L = ((X2/45.8-1.0) \times x2/24.8+1.0) \times X2/4.8 = .577215665-AL06(X)
                                                                               SUN73910
      60 10 5
                                                                                SON73920
                                                                                SUN/3930
ſ:
r
      FOR ABS(X) BREATER THAN 1 APPROXIMATIONS OF HASTINGS ARE USED
                                                                                SUN73940
                                                                                SŰN/3950
    4 P=C((x2+19.494119)*x2+47.411538)*x2+8.493336)/(((4x2+21.361055)
                                                                                SUN73960
     1 *X2+7U.375496) *X2+3U.838227) *X)
                                                                                SUN/397U
      0 = (((x_2+21.383724)*x_2+49.749775)*x_2+5.089504)/(((x_2+27.177958)
                                                                                SON/3980
        *X2+119.91893003X2+76.7U7876)*X2)
                                                                                SUN73990
       co=cos (X)
                                                                                SON74008
       $1=5ÎN (X)
                                                                                S0N74010
      t=n*Cn-P*SI
                                                                                SUN/4020
       V=P*CO+0#SI
                                                                                SUN74U3U
    5 S=V*SG
                                                                                SŮN/404U
       RETURN
                                                                                S0N74U50
       FND
                                                                                SUN74060
                                                                                S0N74070
        FORTRAM RESTOUTABLE
             WASH
CHASH
                                                                                S0N74090
       SUBRUHTINE HASH
                                                                                SUN74100
       COMPLEX VPIC: (15.Du, O, PHIN, CK
                                                                                SUN74110
       CUMMUN/C1/KFOX(2000), XE(5), YE(3), AR(3), X1, X2, X3, X4, Y1, Y2, BETA, NBS SUN/4120
       COMMON/C3/C: (10,28,2),NF(10,2),NF(10,2),NTMAX(2),FN(28),DXE(6),TPISUN/413U
       COMPON/C4/VFIC(30,15),DS(2000),DQ(28,2),Q(1u,10,3),PHIW(5U),CK(4U)SON7646U
       COMPON/C5/MU4(100),NBL(100),FQ
                                          , IFR, XL, NS, NIM, K, J, OR, QI, QAB, QAN SUN74150
       COMMON/CO/X, Y, Dx, oy, EM, FR, EKB, EKR, NP, FP, NB, NBÓX, KODE, MODE, NBW, NBT SON7416U
                                                                                SUN/4170
       COMMON/CB/RHO
       \chi P = \chi
                                                                                SUN74180
                                                                                SUN/4190
       II(NS.FU.2) XP = X - X3
                                                                                SUN74200
       RTM = NT (MOBE, NS).
                                                                                S0N74210
       7 = CO(MUDE, 1, NS)
       nz = 0.0
                                                                                SUN/4220
                                                                                SUN74230
       TE(1:1M.EU.1) BO JU 70
                                                                                S0N7424U
       \kappa = 1
       TF(XP.EU.0.0) GM 10 50
                                                                                SON/4250
       PX = XP
                                                                                SUN/426U
       YX = Y/XP
                                                                                SON / 4270
                                                                                SUN74280
       DO 40 N=2.7
                                                                                SON/4290
              = PX
       PXY
                                                                                SUN74300
       00 30 M = 1.N
                                                                                SON/4310
       \hat{K} = K + 1
                                                                                S0N7432U
       IF (k.GI.NIM) GO TU 20
```

```
ZP=PXY*CO(MOBF, K) NS)
                                                                                  SON/433U
      7=7+ZP
                                                                                  SON74340
                                                                                  SUN74350
      DZ=DZ+ES(KN+ZP)
                                                                                  S0N74360
      PXY=PXY=YX
                                                                                  SUN74370
   All PYERX*XP
                                                                                  S0N74380
   20 DZ=DZZXP
                                                                                  SON74390
      no 10 70
                                                                                  SUN74400
   50 PX=1.0
      no 60 N=2,7
                                                                                  SUN74410
                                                                                  S0N74420
      K=K+N
                                                                                  SUN74430
      KK=K-1
      IF (kk.LE.NT) DZ=UZ+PX*CO(MODE,KK,NS)
                                                                                  SUN7444U-
                                                                                  S0N74450
      PX=PX*Y
      JF(K.GI.NTM) GO TO 70
                                                                                  SUN/446.0
   on 7=7+PX*CQ(Mone,K, 4S)
                                                                                  SUN/447U
                                                                                  SON/4488
   71 GO TO (80,911), NS
   UN NS(NA) = CMM X COZ; EK*Z)
                                                                                  SUN74490
                                                                                  SUN74500
      RETUPN
   90 DS(1^{\circ}R) = CMPLX(4Z)Ek*Z)
                                                                                  SON/4510
                                                                                  SUN74520
      REJURN
                                                                                  SUN/453U
      FNI
                                                                                  SGN/4540
        FOILTRAN NESTOUSPECK
CPH In
                                                                                  S0N74560
             BHIR
                                                                                  SUN74571
      SURKOUTINE PHIB
      COMPLEX VPIC:0S. NO. G. PHIW, CK&CZERO, PHI, PHITE, DPHI, SPHI
                                                                                  SUN/458U
      ĊᲘMYON/C4/YET:(ᲙᲗ;15%,DS(20ÓĎ),BQ(28,2),Ğ(1Ŭ,10,3),PHÍN(50),CK(4Ô)SON7646U
                                            JER, XL, NS, NIM, K, J, QR, QI, QAB, QAN SON74600
      COMMON/C5/MGR(190), GUL (100), FO
      COMMON/C6/X, Y, Px, JY, EM, EK; EKB, EKR, NF, MP, MP, NB, NBUX, KUDE, MODE, NBW, NBT SCN7461.0
      COMMON/CJ/CZFRO, P4I, PHI1E,DPHI3 SPHI
                                                                                  S6N/462U
      COMMON/C8/REG
                                                                                  SUN74630
      NU≐NINO (NP>15)
                                                                                  SUN7464U
      DO: 20 1=2, Nu
                                                                                  SUN/4650
      RU=NP-I+1
                                                                                  SUN74060
       дв=нов(иО)
                                                                                  SUN/4670
      NJ=MBL(NU)+10
                                                                                  S0N74688
                                                                                  SGN74690
      po 20 J=1, JF
                                                                                  SON/4700
      K=1+IABS(MP-J)
                                                                                  SNN7471.U
       HPH1=VPIC(K.I)
       IF (J.EQ.1) GO TO 1m
                                                                                  SUN74720
       K=MP+J-1
                                                                                  SON/4730
                                                                                  SUN74740
       BPH (= DPHI+VETC(<, 1)
                                                                                  SON74750
   10 SPHI=SPHI+DFHI* 'S(NJ)
                                                                                  S0N74760
   21 NJ=NJ+1
       RETURN
                                                                                  SUN14771
                                                                                  SUN74780
       EMB
                                                                                  SUN747911
        FORTRAM NESTOU, DECK
CHSIMEC
             MSIMEC
                                                                                  SUN/481U
       FUNCTION MSIMFC (M; N, L, A, B)
                                                                                  S0N74828
       CUMPLEX A, B, G
                                                                                  SON74830
       BIMENSION ALM, 1), B(B), 1)
                                                                                  SUN7484U
       nò 30 J = 16 N
                                                                                  SUN/485@c
       C = 0 \cdot \cdot 0
                                                                                  SUN/4860
                                                                                   SON/48/U
       por 10 J = 1.8
   1 U C=AMAX1(C,AMS(REAL(AGI,J))),ABS(AIMAG(A(G,J))))
                                                                                  SON74880
       TECC. FO. 0.00 ON TO 1808
                                                                                  S0N74890
       0.020 J = 1.0
                                                                                  SUN74900
   2\pi \Lambda(\Gamma_{\varepsilon}J) = \Lambda(\Gamma_{\varepsilon}J)/C
                                                                                  S0N74910-
                                                                                  S0N7492U
       no 30 J = 1.1
   3(1,1)B = (1,1)/C
                                                                                  SON/4930
                                                                                  S0N74940
       [F(N.EG.1) OO TO 205
```

```
NM = N - 1
                                                                                                                                                                    S0A/4950
             B0.200 J = 1.0M
                                                                                                                                                                    SUN74960
             C = 0.0
                                                                                                                                                                    S0N7497U
             K = 0
                                                                                                                                                                    SUN74980
             D# 40 I = J.N.
                                                                                                                                                                   S0474990
             D=APSGREAL(A(I,J)))+ABS(AIMAG(A(I,J)))
                                                                                                                                                                   S0N750,00
              TF((.GE.D) (0 T | 40
                                                                                                                                                                    SON75011
             K = 1
                                                                                                                                                                    SUN75020
             C = \Phi
                                                                                                                                                                   :SON/5030
       40 COMMINUE
                                                                                                                                                                    S0N75040
              If (+. EQ. U. OF. C. LT. 1. F-7) 80 TO 1000
                                                                                                                                                                   :SUN751151
              If (b.+Q.J) on II /0
                                                                                                                                                                   SUN/5060
             m_i t_i = U_i \cdot 0: 0 \cdot 0
                                                                                                                                                                   S0N75070
             (しし、しょ) ハニの
                                                                                                                                                                   SUN/5080
             \Lambda(J,JJ) = \Lambda(K,JJ)
                                                                                                                                                                   S0N75090
      D=(LE, 8)A PC
                                                                                                                                                                   SUN751 UII
             1.1 = UL OA OA
                                                                                                                                                                   SUN/511 U
             G=F(J,JJ)
                                                                                                                                                                   SUN/5120
             R(J_{*}JJ) = R(K_{*}JJ)
                                                                                                                                                                   S04/5186
     ある H(ド, リリ)=G
                                                                                                                                                                   `SUN7:51:4#
       /9 G=1.8/A(J,J)
                                                                                                                                                                   SUN/5150
              IP = J + 1
                                                                                                                                                                   SON75160
             M_{\rm c} q_{\rm L} = L U HB HR
                                                                                                                                                                   SUN7517.0
      84 A(J, JJ)=A(J, I) +G
                                                                                                                                                                   S0N/5180
      1.1 = "UU (181 QII PY
                                                                                                                                                                   SUN751911
    1 ևո ռ( ւ. յյչ≖8(յ, յո) ∗ռ
                                                                                                                                                                   SONJOZER
             BO 280 I = 1,2
                                                                                                                                                                   $0N752.60
             11 (1.Es.J) 60 To 206
                                                                                                                                                                   S0N752211
             G_V(I')
                                                                                                                                                                   S0N/5230
             NO 11:0 JJ = JP, 4
                                                                                                                                                                   SON/5248
    119 A(I,JJ)=A([,Ji)-6*A(J,JJ)
                                                                                                                                                                   S0N75250
             B9 128 JJ = 1,1
                                                                                                                                                                   SUN75260
    120 B(I,JJ)=B(I,JJ)-G*B(J,JJ)
                                                                                                                                                                   S0N75270
    200 CONTINUE
                                                                                                                                                                   SUN75280
 . 205 G=A(N,N)
                                                                                                                                                                   SUN75290
              IF (ABS(RFAL(G))+ABS(ALMAG(G)),LT.1.E-7) GO TO 1000
                                                                                                                                                                   SUN/5300
             no 210 J = 1.4.
                                                                                                                                                                   SUN753118
    210 B(N,J)=B(N,J)/C
                                                                                                                                                                   SON75320
              {f(o. FQ.1) 50 T⊕ 23#
                                                                                                                                                                   $:0N75.3,3a
             00 220 1 ± 1.0M
                                                                                                                                                                   SUN75340
              0.05 \times 20 \text{ JJ} = 3.0
                                                                                                                                                                   SUN75350
    (LL, N) = R((1, 1) = R((1, 1)) = R((1, 1
                                                                                                                                                                   SUN/5360
    200 MSTREC=1
                                                                                                                                                                   S0N/5370
             RETURN
                                                                                                                                                                   SON/5580
  1000 MSIMEC=2
                                                                                                                                                                   S0N75390
             PETURN
                                                                                                                                                                   SUN75400
             FND
                                                                                                                                                                   SUN/5410
               FORTRAL MLSTOB DECK
                                                                                                                                                                  SUN/5420
COCLA
                           DULJ
                                                                                                                                                                  S0N75440
              SURFORITHE TOTAL
                                                                                                                                                                  SUN/5450
             COMPLEX VPIC, 6S, Dec Co PHIW/CK, CZERO, PHI/PHITE, OPHI/SPAI
                                                                                                                                                                   SON75460
             COMMON/C1/K) OY(2010), XF(5), YE(3), AR(3), X1, X2, X3, X4, Y1, Y2, BETA, NBS SON/5470
             CUMMON/C3/C (10,24,2),NI(10,2),NF(10,2),NTMAX(2),FN(28),DXE(6),IPLSON/5480
             COMEON/C4/VP (1.(30,15), DS(2000), bQ(28,2),Q(10,40,3),PHIMC500,CKC409SONA64.60
             COMPON/CD/MOR(100), DBL(100), FQ
                                                                                       TER, XL, NS, NEMARA JAMPA GEORGE OF SON SON 5500
             COMMON/C6/X, Y.DX, AY, EM, EK, EKB, EKR, NP, MP, NB, KBOX, KODE, MODE, NBW, NBF SON/5510
             .COMEON/C&/C/FRO, Pol, PHILE, DPHI, SPHT
                                                                                                                                                                   S.ON #5 5:2(0)
             COMMON/C87R+0
                                                                                                                                                                   S0N75530
             nPHI = PHI**xF(<0)E)
                                                                                                                                                                   SUN/5540
              IF (MP.FU.1) DPH1 = 0.5*0PH1
                                                                                                                                                                   SUN75550
```

```
S0N75560
      XP = X
                                                                                 S0N75570
      (F_1(NS.EU.2) XP = x - X3
                                                                                 .SON75580
                                                                                 SUN/5590
      K = 1
                                                                                 S0N75600
      (REM) XAMIN = MEM:
                                                                                 SUN35.610
      no(1,NS) = no(1,NS) + nPHI*CMPLX(0:0,-EK)
                                                                                 S0N7562U
      # (NTH.EQ.10) GO TO 50
      3F(XP.Eu.8.0) 89 10 30
                                                                                 SON75630
      \dot{Y}X = Y/XP
                                                                                 S0N75040
      109 20 N = 2,7
                                                                                 .SUN75658
                                                                                 SUN/56.60
      7 = P.X.
                                                                                 S0N7567U
      BO 10 M = 1,N
                                                                                 SUN75680
      K = K + I
                                                                                 SUN/5690
      AUGNAGTANIMA GO TO SI
                                                                                 SUN/5.7.08
      DO(KINS) = LO(KINS) + DPHI*Z*CHPLX(FN(K)/XPI-EK)
                                                                                 SUN75710
   10.7 = .2 * YX
                                                                                 SUN75720
   2a PX = PX*XP
                                                                                 SUN757311
      80 10 50
   30 PX = 1.40
                                                                                 S0875740
                                                                                 SUN7575#
      DU 40 N = 2,7
                                                                                 S0N75760
      (K = 1 K + N
                                                                                 S0475770
      KK = K - 1
                                                                                 S0N75780
      THE (AKE A PENT) OF THE (NKINS) = DOCKKINS) + DPHI*PX
                                                                                 SUM7579%
      Px = Px * Y
                                                                                 อบฟ758บบ-
      TF (ra 3]. NTMJ 30 79 50.
                                                                                 SUN/5810
   40 po(ki/s) = 00 (KiNS) + PPHI*CHPLX(U.U. HEK*PX) .
   59 1F (NOTE - ME - 4) GU 10 90
                                                                                 S0N/5820
       BPHJ = BPHI/NXF (KaDE)
                                                                                 SUN75830
                                                                                 SUN75840
       R = 1.
                                                                                 S0N75850
      YX = Y/XP
      PX = 7.0/DX
                                                                                 SUN/5860
      mu /0 w = 1,7
                                                                                 SUN75870
                                                                                 S09//5880
      7 = PX
                                                                                 SUN75896
      30 O M = 150
      用の(体が) き inti(K・N5) ー 甲PHI+Z
                                                                                 SUN759.00
                                                                                 SUN/5910
      K = K + 1
      BEACK OF NIM) GO THE BO
                                                                                 S0N75921
   64 7 = 7*YX
                                                                                 SUN/5930
                                                                                 SUN/5940
   74F (PX) ≠ (PX*XP)
   あn ARG = Eを#CX3 - Xio
                                                                                 S0N75950
      mphy = -DPHy*cmpl x(cos(ARG), -SIN(ARG))
                                                                                 SUN75961
                                                                                 SQN/597/0
       0.00 = 10
      CALL OFGE
                                                                                 S0N75988
   90 TECHODE NE.D) RETURN
                                                                                 SUN75994
                                                                                 SUN76000
       XE = X4
       BE(MP, 40.1) Proliff = 0.5*PHITE
                                                                                 SUN76910
      ment = thate
                                                                                 S0N76U20
      CALL OFFE
                                                                                 SON76.030
                                                                                 S0N/6040
      RETURN
                                                                                 SUN/6050
      END
       FORTRAIN INLESTIBLE DEFOR
                                                                                 $UN7:6:060
CIPFICE
             OEGE
                                                                                 :S0N7.6.0:8:0
      SUPROUTIENE UFGE
                                                                                 SUN764190
      COMPLIEX WPTC auson to corphily CKaCZERO PHILAPHITE ADPHILASPHI
                                                                                 S0N76100
      COMERRA/CA/APACCEO 40 - 45 0 - ASCADADO - DACES - 20 - QCC 4 - 40 - 30 - 30 - PHANCES - ACKCEO FSUN/6460
      COMMON/C5/MIRGO 000 ARE COOD AFO
                                           → IIIIRAXLANSANIMAKAJAQRAQIIAQABAQANGSUNV6120
      ICOMMON/ICO/Xxxxx的内容,以及证据检查技术,连张图,IENRo/NP /PP //NB,从RUX,IKUDE,他ODE,NBW //NBT //SUN//O/LSU
      COMPONICZICZEROSPANSPANIĒSDEHISSPAN
                                                                                 S0N76140
                                                                                 S0N76150
      COMMON/CS/RED
                                                                                 S0N7.6160
      PX=1.070X
```

\$

```
1F(XL.Fu.0.0) G0 10 30
                                                                             SDN76170
      YX=Y/XL
                                                                             SON76180
      K = 1
                                                                             SUN7619U
      mo 20 H=1.7
                                                                             S0N/6200
      PY=FX
                                                                             SUN76210
      110' 10 M=1,N
                                                                             SUN76220
      \hat{n}O(\hat{r},2) = \hat{n}O(\hat{r},2) + \hat{D}PHI + \hat{P}Y
                                                                             SUN7.6230
      IF (K.EG.NIM) RETURN
                                                                             SON76240:
      K=K+1
                                                                             $0N762511
   In PY=PY*YX
                                                                             SUN76260
  2# PX=PX+XL
                                                                             SUN76270
      RETURN
                                                                             S0N76280
   30 K = B
                                                                             SUN76290
      no 40 N = 1.7
                                                                             S0N7630U
      x - k + N
                                                                             SQN/631U
      IF(k.GI.NIH) RETURN
                                                                             S0N7632U
                                                                             SUN76330
      \hat{\mathbf{D}}(\kappa,2) = \mathbf{D}(\kappa,2) - \mathbf{DPRIMPX}
   4\pi PX = PX \bullet Y
                                                                             SON/6340
      RETUPU
                                                                             SUN76350
      ENT
                                                                             SUN/6360
       LOVIRAN MESTAD, DECK
                                                                             SUN/6370
TH ) 43)
            bling.
                                                                             SUN/6390
      (Ø) D FOOT ANTTOORAUZ
                                                                             S0N7640U
      COMPLEX VPIC.DS.Da.u.PHI4.CK.CZERO.PHI.PHITE.DPHT.SPH1
                                                                             S0N7641U
      BIMENSTON SECS. 3) SURF (2,3) CODOT) C (50)
                                                                             SON/6421
      DIMENSION CARUS(25050)
      COMMON/C1/K2OX(2000),XE(5);YE(3);AR(3),X1,X2;X3,X4,Y1,Y2;BETA,NBS SON/6430
      COMMON/C2/An, MACUSEMACH(6),NEREQ,ÉREC(10),NHODE,NSURÉ,LYPIC,USSYPSON/6440
      CUMMON/C3/C0(10,2q,2),NI(10,2),NF(10,2),NTMAX(2),FN(28),DXE(6),TPISON/645U
      COMMON/C4/VFTC(80,15),DS(2000),DQ(28;2);Q(10,10,3);PHIW(50);CK(40)SON/646U
      COMMUNICS/MOB(100), NRL(100), FO : TER, XL, NS, NTM, K; J, QR, UI, QAB, QAN SON76470
      COMPON/C6/X,Y,Dx,OY,EM,EK,EKB,EKR,NP;BP,NB,NBOX,KODE,MODE,NBW,NBT SON/6480
      COMMOUTC7/CZEKO, PHÍ, PHITE, DKHI, SPHI
                                                                             S0N7649U
                                                                             S0N76500
      COMMON/C8/RHO
      HATA (SH(1,1),1=1,6)/26HMAP OF SONIC BOX OVERLAY
                                                                             SUN/6510
                                                                             SUN/6520
                             26HON: WING, TAIL AND WAKE
                                                                             S0N76530
     2
                                          (S) - WING
                             26H
                                          (S) - TAIL
                             26H
                                                                             S0N76540
     ٠,
                                          (,) - HAKE
                             26H
     40
                                                                             SON76550.
                                                                             SUN76560
                             39H
                                          ,8HTAIL
                                                                             SUN/6570
      DATA (SURF(1,1),1=1;5)/8HNING
                                                      ,11HWING + TATE. /
      DATA COD/145,1H5,1H5,1H5,1H5,1H5,1H-,1H-/
                                                                             S0N76580
                                                                             SON76590
      GO FO (10 ,20 ,40 ,40 ,50°,60 ,70 ;80 ), IND
   SUN76690
                                                                             SUN76610
     IAR(1), AR(2), NBW, NHT, NBS, NBS
   11 FORMATCIHI/////3·X,43HHAC/NAA MISSILE TRANSONIC AIRLOADS PROGRAM SUN76620
     1 ///37x,30HFLIGHT COUNTITIONS AND GECHETRY/1HO//15X, 13HMACH NUMBERSUN7663&
     2 =,18.5,4X,164SPFLD OF SOUND =F10@3,4H L/T,4X,4HRHO=,E14.8//1HO/
                                                                             S0N766411
                                                                             SUN76650
     X54X,4HWING,18X,
     3 4H1A1L///22%,15H1.1. STATION (L),2F22.3//22X,16HROUT CHORD
                                                                         (L), SUN76660
                                      (L),2f22.3//22X,16HT.L. SPAN
     4 2F22.3// 2/X,15HL.F. SPAN
                                                                         (L) SUN76670
     5 2F22.3// 2/V/19HCIP CHORD
                                       (L),2622.3//22X,16HTOTAL AREA (L*L),SUN/668U
     6 2022.3// 22x, toHCHORDWISE BOXES , 119,122//
                                                                             SUN76090
                                         J119, 122)
                 22X, 16HSPANNISE BOXES
                                                                             SUN76700
      kŘÍTF(6,12), BOX, DX, DY
                                                                             S0N7671U
   12 FORMAT(1HU/,11X,25HTOTAL CHURDWISE BOXES =,13, 5X,11HBOX CHURD =, SUN7672U
     1 1PtF12.5,2P 1, 54,10HBUX SPAN =,1P1F12.5,2H L/
                                                                             S0N76730
                                                                             S0N76740
      WRITE(6,91)
                                                                             SUN76750
      NB = 1
                                                                             SUN76760
      10 17 NP = 1.4821X
```

```
PB = MOB(NP)
                                                                            SUN76770
    DO 13 HP = 1, HB
                                                                            SON76780
    K = KROX(NR)
                                                                            SUN 26790
    C(MP) = COD(K)
                                                                           S0N76800
 13 \text{ NB} = \text{NB} + 1
                                                                            S0N7681U
    IF (NP.GT.6) on 10 15
                                                                           SON76820-
    %RTTE(6,14)(SH(1,4P),1=1,5),(C(MP),MP=1,MB)
                                                                           S0N76838
 14 FOFMAT(10X,5A6,50A1)
                                                                           SON7684U
    GD 10-17
                                                                           S0N76850
    WR9TE(6,16) (C(4P), HP=1, MB)
                                                                           SUN76860
 16 FUPMAT (40X,50A1)
                                                                           SUN76870
    CONTINUÉ
                                                                           SUN76886
    60- TO 1000-
                                                                           S0N76890
    kRITE(6,51)FRED(IFR), NROXYEKR
                                                                           SUN769.00
    後RT-1F(6,21)
                      eM, ERB
                                                                           SUN76910
 21 FURMAT(IH ,28%,484PLANAR VELOCITY POTENTIAL INFLUENCE CUEFFICIENTSSON76920
   1 /1H0,3UX,1H44ACH ND. =,F8.5;1OX, OHKBAR =,F9.5/1HU,13X,1H1,5X,1HJSON7693U
   2 10x,5HNUBAP,5x,5HHUBAR,11X,14HREAL VPIC(J,1),8X,14HIMAG VPIC(J,1)SUN76940
   3 /11 )
                                                                           SUN/6950
    JBOY = 2*MOH(NBOX)-1
                                                                           SUN76960
    180x = MINO(NEOX, 15)
                                                                           SUN7697U
    10^{\circ} 22^{\circ} T = 1.740x
                                                                           S0N76980
    RB 22 J. = 1,3a0x
                                                                           S0N76990
    BAPOU = J = 1
                                                                           SON/7:000
    BARRU = 3 - 1
                                                                           S0N77010
 22 WRITE(6,23) T.J. BARNU, BARMU, VPIC(J.I)
                                                                           SUN 37020
    FORMAT(9X,216,4x,2F10.1,2x,1P2E22.5)
                                                                           SUN/71130
    GO 40 1000
                                                                           SUN77048
 3# kRITE(6,51) FRF¤(IFk),NbÔX,ÈKR∴,EM
                                                                           SUN/7050
    HRTTE(6,31)rene
                                                                           SUN7706U
 31 FURMAT(1H ,21x, >9 HUPPER VELUCITY POTENTIALS AND SURFACE UPWASHES FSON /7070
   COR MODE NO., 13/ 100, 9x, 1HH, 6X, 1HH, 5X, 2HNB, 7x, 10HR PHI(N, M), 7x, 10HISON 77080
   2 PHI(N, M), 10X, 94R W(N, M), 8X, 9HI W(N, M)/1H )
                                                                           S0N/71190
    60 10 1000
                                                                           SUN77100
 40 SPH1 = DS(NIG)/E4
                                                                           S0N7711u
    WRITE(6:41)mp.Ma.xB.SPHI.CK(MP)
                                                                           SON//120
 91 POKMAT (4X,317,122,17.5, 3X, 1P2L17.5)
                                                                           SON/7130
    60 10 1000
                                                                           SUN/75140
 60 IF(MS.EQ.3) ON IN 100
                                                                           SON/7450
 50 KRTTE(6.51)1 REGGTER), NBOX, EKR , EM
                                                                           SUN/7160
 51 FORMAT(1H1,33x,43HMISSILE TRANSUNIC AIRLOADS PROGRAM (CONT+D)//1HOSON/717u
   1 8x,27HOSCILLATORY EREQUENCY (CPS), f12.5,14x,12,25H BOXES IN CHORDSON7718U
   2 DIRFCTION / tho, 8x, 30HREDUCED FREQUENCY (SEMI CHORD), F9.5, 14x,
                                                                           S0N/719U
   3 23hFREE STEFAM MACH NUMBER, F9.3,/1H )
                                                                           SON/7200
    hRITE(6,101) SURF(1,NS)
                                                                           SUN77210
101 FORMAT(28X, 45HT POT MODE SHAPE POLYNOMIAL CUEFFICIENTS FOR , A6/
                                                                           SUN77220
   J ?2x562HREFFRENCEA 60 THE SURFACE LEADING EDGE-CENTERLINE INTERSECSON/7230e
   21 TON //2X, 4HMDDE, 20X, 7HCUEFFS.)
                                                                           SUN77240
    DO 182 I=1; MADE
                                                                           SON77250
    NIM=NT(I,NS)
                                                                           SON/7260
102 WRITE(6,103) 4, (CU(1,J,NS),J=1,NTM)
                                                                           SUN/7270
107 FORMAT(1HU, 14,4X,1P7F13.4/(9X,1P7E13.4))
                                                                           SUN/7280
100 WRITE(6,51)FREQCIFR), NBOX, EKR
                                                                           SUN/7290
    RRITE(6,61)(SdRF(1,NS);1=1,2)
                                                                           SON/7360
 61 FORMAT(1H .35%, 23HGENERALIZED FURCES FOR .2A6/1H0.6X, 4HDEFL, 3X,
                                                                           SON 27310
   1 AHLGAD, 10X, 9HRFAL PART, 10X, 9HIMAG PART, 10X, 9HAUS VALUE, 10X,
                                                                           S0N/732u
   2 1THPHASE AUGUS //)
                                                                           SON/7330
    GO 10 1000
                                                                           SUN/7340
 70 LRITE(6,71)J.K. JR.QI.QAB.UAN
                                                                           SON77350
    KKK=5*NMODE
```

```
NNN=2+K
     NNNN=NNN-1
     CARIS(J, NNNE) = OR
     CAPUS(J, NNN)=01
     IF (NSURF . FO. 1) GO TO 667
     4F (NS.NE.3) GO TO 1000
 667 IF (J.NE.NMODE) GO IN 1000
     IF (K.NE:NKUDE) GO TO 1000
     KKK=2*NHODE
     PUNCH 666, (CARUS(II, JJ), JJ=1, KKK), II=1, NMODE)
 666 FÜRHAT (6E12.5)
  /1 FOPHAT(1HU:19,1/,2X,1P3E19.5,0PF16.3,4H DEG)
                                                                           SON77360
     GO 10 1000
                                                                          SON77370
  bn write(6,913
                                                                          S0N77380
     WRITE(6,81) [REJ(IER)
                                                                          S0N77390 .
  61 FORMATCIHU/////24X,56HUNABLE TO OBJAIN COMPLEX SIMULTANEOUS EQUATSON/7400
    TITOPS SOLUTION//31%,420CQMPUTATIONS FOR THIS FREQUENCY TERMINATED//SON77410 .
    2/45x, 6HFRE. =,19.3)
                                                                          SUN77420
  91 FURMAT(4H1,30x, 13 IMISSILE TRANSUNIC AIREDADS PROGRAM (CUNT-D)//)
                                                                          SUN77430
1:000 RETURN
                                                                          SUN7744U .
     Enn
                                                                          SON77450
```

## 5.0 SUPERSONIC UNSTEADY AERODYNAMICS

## 5.1 Theoretical Derivation

For Mach numbers greater than 1.0, the linearized flow equation becomes a hyperbolic differential equation:

$$(M^{2}-1) \phi_{\hat{x}x} - \phi_{\hat{y}\hat{y}} - \phi_{zz} = -M^{2} \left[ 2ik \phi_{x} - k^{2} \phi \right]$$
 (5.1.1)

The equation only has solutions within characteristic regions called Mach cones. Linearized supersonic flow theory has led to closed-form solutions for many types of lifting surfaces in steady flow. These solutions are easily derived because the influence of a small perturbation is confined to its downstream or aft Mach cone. Conversely, the only disturbances that can influence a particular point are confined to its upstream or fore Mach cone.

Equation (5.1.1) is satisfied by a pulsating source. The source, placed at  $(\xi,\eta,\zeta)$ , emaintes spherical disturbances and has a velocity potential induced at (x, y, z) given by

$$\phi_{g} = A (\xi, \eta, \zeta) G (x-\xi, y-\eta, z-\zeta)$$
 (5.1.2)

where

G 
$$(x-\xi, y-\eta, z-\zeta) = -\frac{1}{\pi R} \exp \left[-i\overline{k} (x-\xi)\right] \cos \left[\frac{\overline{k}}{M}R\right] (5.1.3)$$

$$\hat{R} = \sqrt{(x - \xi)^2 - (M^2 - 1)[(y - \hat{\eta})^2 + (z - \xi)^2]}$$
 (5.1.4)

$$\overline{k} = k M^2 / (H^2 - 1)$$
 (5.1.5)

and A ( $\xi$ ,  $\eta$ ,  $\xi$ ) = source strength

This type of disturbance has no influence outside the down-stream Mach cone and is discontinuous at the point  $(\xi, n, \zeta)$ . To provide the necessary antisymmetry of disturbances associated with lifting surfaces, we place a pair of sources on either side of the z=0 plane and require the lower source strength to be equal in magnitude but opposite in sense to the upper source strength.

Applying this source superposition technique to the wing, wake and control surface, the entire z=0 plane is covered above and below with source sheets. The strength of the opposing sheets are equal in magnitude but opposite in sense;  $A(\xi, \eta, 0^{-}) = -A(\xi, \eta, 0^{-})$ . The strength distribution has been shown by Garrick and Rubinow (Reference 8) to be equal everywhere to the local downwash. Using this condition, we have

$$A(\xi, \eta, o^{\dagger}) = w(\xi, \eta, o^{\dagger})$$
 (5.1.6)

The velocity potential at (x, y, 0+) can be written as

$$\phi = \iint w(\xi, \eta) G(x - \xi, y - \eta) d\xi d\eta \qquad (5.1.7)$$

The range of integration extends over the region contained in the fore Mach come of the point.

In the wake region between the wing and control surface, the downwash must be determined to satisfy the continuous pressure condition. This is the same relationship given by Equation (4.1.7) in the transonic unsteady aerodynamics discussion. Substituting Equation (5.1.7) in the wake condition gives

$$\iint_{W} (\xi, \eta) G(x - \xi, y - \eta) d\xi d\eta = \phi_{\text{wing t.e.}} \left[ \exp(-ik(x - x_{\text{wing t.e.}})) \right] (5.1.8)$$

This relationship which requires knowledge of the upstream downwash within the fore Mach cone to solve for the local downwash.

The preceding discussion applies only to lifting surfaces with supersonic leading edges. When the leading edges are supersonic, the fluid flow over the top and bottom of the lifting surfaces are completely isolated from one another. To treat the problem of subsonic leading edges, the concept of a diaphragm of unknown downwash is added to the planform. The diaphragm region is between the Mach envelope and subsonic edge. The diaphragm downwash is found by applying the condition of zero pressure:

$$0 = \iint_{W} (\xi, \eta) G(x - \xi, y - \eta) d\xi d\eta$$
 (5.1.9)

The downwash of the diaphragm creates an additional contribution to the pressure profile over the planform.

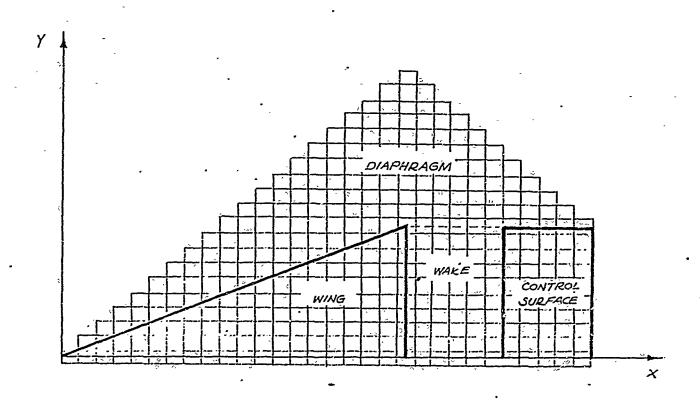


Figure 5.1.1 Mach Box Overlay Pattern

The velocity potential distribution is found by the so called Mach box method. The wing, control surface, wake and diaphragm regions are covered with a grid of rectangular boxes of length  $\Delta$ . The width of the boxes is set equal to  $\Delta/\sqrt{M^2-1}$  thus making the box diagonals parallel to the Mach lines. The source strength (downwash) is assumed constant over each box and equal to the value at the box center. A typical Mach box overlay is shown in Figure (5.1.1).

From the conditions imposed on the planform, the downwash can be numerically evaluated for the diaphragm and wake boxes and the velocity potential profile can be established for any deformation mode. The pressure can then be calculated from Equation 4.1.8 and generalized forces can be evaluated with Equation 2.0.1.

## 5.2 PROGRAM DESCRIPTION

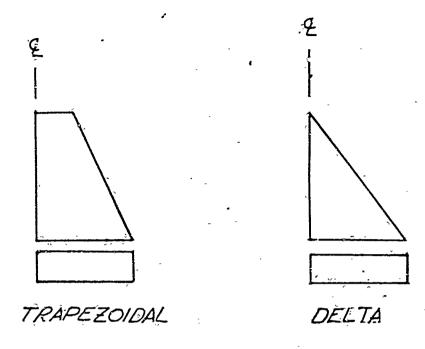
The Supersonic Unsteady Aerodynamics Program calculates generalized forces for up to 10 deformation modes. The computer solution is based upon the Mach box technique. The various configurations which can be analyzed are shown in Figure 5.2.1 and Table 5.2.1. The analysis includes interaction effect between tandem surfaces and wake effects on the trailing surface. Single surfaces may be analyzed by inputing a second surface with a zero chordlength.

The supersonic Mach box method uses source superposition method to approximate the aerodynamic forces on an oscillating thin planar surface. The diaphragm concept was employed to handle subsonic leading edges and gaps between the aerodynamic surfaces. For purposes of calculating pressures, it was assumed that the source strength over the area of each box is a constant value which satisfies the condition of tangential flow at the center of the box. The Mach box procedure is basically the same as the method of Pines, et al, Reference II, differing only in that the surface and diaphragm is overlaid with a grid of rectangular boxes, the diagonals of which are parallel to Mach lines. As in the subscric and transonic cases, the potential equation is written as an integral equation (this time relating the downwash to the source strengths) and approximated by a matrix equation. The numerical difficulties are primarily ones of computer logic since the zones of influence of a given Mach box is limited to the region within the aft Mach lines. The matrix formulation leads to a partitioned form since there are two boundary conditions to be matched. The first boundary condition is the downwash on the surface, and the second is that there be no pressure difference off of the surface in the diaphragm regions. The zero pressure conditions leads to a relationship between the diaphragm potentials and the surface potentials, and the surface downwash condition then leads to the surface potentials. The surface pressures then follow from the surface potentials.

The solution for the generalized aerodynamic forces requires the input of the deformation modes due to vibration. The program considers the modes to be expressed as analytic functions of the form:

$$w(x, y) = \sum_{m=0}^{N} \sum_{m=0}^{n} c_{(n-m), m} x^{(n-m)} y^{m}$$

To meet this requirement only the coefficients "c" are required as input into the program. These coefficients can be obtained in several ways, the most common way is to surface fit the modes by the least-square technique.



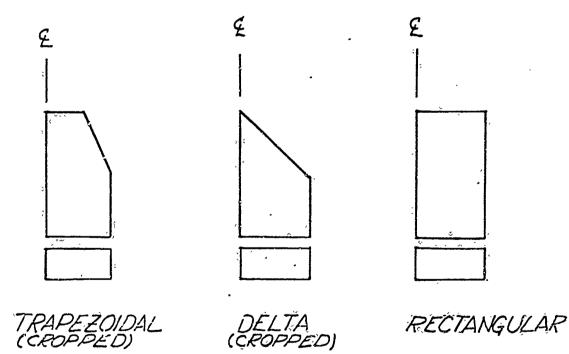


FIGURE 5.2.1 -TANDEM COPLANAR CONFIGURATIONS AT SUPERSOMIC MACH NUMBER

TABLE 5.2.1- OPTIONAL CONFIGURATIONS

CONFIGURATION	CHORDINATE COORDINATE	SPANWISE COORDINATE
-	X(1) ± 0.0	Y(1) = 0.0
	x(s) = 0.0	Y(2) = 0.0
RECTANGULAR	x(3) > 0.0	Y(3) > 0.0
_	$X(4) \ge \hat{X}(3)$	
	X(5) ≥ X(4)	-
Ò	X(1) = 0.0	Y(1) = 0.0
	x(2) > 0.0	X(5) = 0.0
DĘĻTA	$\chi(3) = \chi(2)$	Y(3) > 0.0
	$\chi(4) \ge \chi(3)$	
	x(5) ≥ x(4)	,
	X(1) = 0.0	Y(1) = 0.0
-	$\chi(2) > 0.0$	X(5) > 0.0
ŢRAPEZOIDAL ,	x(3) = x(2)	Y(3) > Y(2)
	$x(4) \ge x(3)$	
	$\chi(5) \ge \chi(4)$	-
	$\dot{x}(1) = 0.0$	Y(1) = 0.0
	x(2) > x(1)	Y(2) > 0.0
TRAPEZOIDAL (CROPPED)	x(3) > x(2)	X(3) > X(5)
	$x(4) \ge x(3)$	
	X(5) ≥ X(4)	
	x(1) = 0.0	Y(1) = 0.0
	x(2) > 0.0	Y(2) = 0.0
DELTA (CROPPED)	x(3) > x(2)	X(3), > X(5)
	$X(4) \geq X(3)$	
-	$\chi(5) \geq \chi(4)$	

ß.

Section of the section of

The second of th

Concessor ,

## 5.3 INPUT INSTRUCTIONS

Instructions for preparing input data for the supersonic computer program are presented here. The field location and format for each quantity is specified. Any set of units may be used for geometric dimensions and acoustic velocity as long as they are consistent, e.g., if inches is used for length, then the acoustic velocity must have dimensions of inches per second. The required data and the sequence in which the information is entered is as follows:

## 1. Streamwise Coordinates (6E12.5 for mat)

Column	T-12	13-24	25-36	<sup>™</sup> 37–48	49-60	61-72
Name	X(1)	X(2)	X(3) '	X(4)	X(5)	
Item	(1)	. (2)	(3)	(4)	(5)	

- (1) X(1) Wing root leading edge coordinate (see Figure 5.3.1)
- (2) X(2) Wing tip leading edge coordinate
- (3) X(3) Wing trailing edge coordinate
- (4) X(4) Control surface leading edge coordinate
- (5) X(5) Control surface trailing edge coordinate

A single surface, the wing, may be analyzed by setting X(4) and X(5) equal to X(3). The various configurations are generated as shown in Table 5.2.1. The origin for the planform and AlC station coordinates must be at the leading edge root of the wing, therefore X(1) and Y(1) described below, must always be zero.

## 2. Spanwise Coordinates and Acoustic Velocity (6E12.5 format)

Column	1-12	13-24	25-36	37-48	49-60	61-72
Name	Y(1)	Y(2)	Y(3)	SOUND	RHØ	,
Item	(1)	(2)	(3)	(4):	(5)	• *~

- (1) Y(1) Wing root spanwise coordinate
- (2) Y(2) Wing leading edge spanwise coordinate
- (3) Y(3) Wing (and control surface) tip spanwise coordinate
- (4) SOUND Speed of sound at altitude for which analysis is performed
- (5) RHØ Density of fluid \* 1000.0 (M./ $L^3$ )

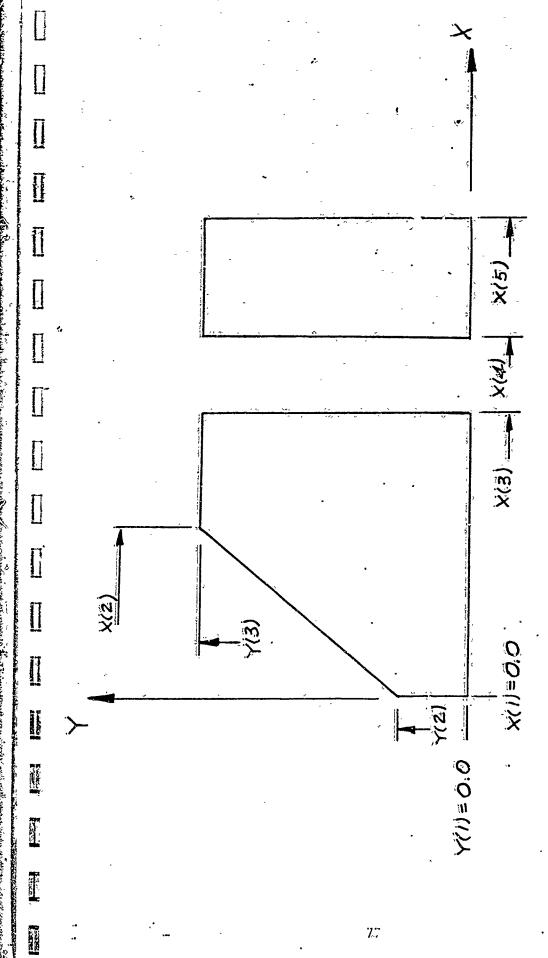


FIGURE 5.3.1 GEOMETRY DESCRIPTION

3., General Information (6112 format)

Column	1-12	13-24	25-36	37-48	49-60	61-72
Name	NMACH	NFREQ	NMODES	NBW .	LYPIC	LSSVP
Item	(1)	(2)	(3)	(4)	<b>(5)</b>	(6)

(1) NMACH Number of Mach numbers (max 6)

(2) NFREQ Number of input frequencies (max 10)

(3) NMODES Number of input modes (max 10)

(4) NBW Number of chordwise wing boxes (max 10)

(5) LVPIC Print velocity potential influence coefficients; 0 ~ No, 1 ~ Yes.

(6) LSSVP Print upwashes; 0 ~ No, 1 ~ Yes

4. Mach Numbers (6E12.5 format)

Column	1-12	13-24	25 <b>-</b> 36	37-48	49-60	61-72
Namë	FMACH(1)	FMACH(2)	FMACH(3)	FMACH(4)	FMACH(Ŝ)	FMACH(6)
Item	(1)	(2)	.(3)`	(4)	<b>(5)</b>	(6)

- (1) FMACH(i) Mach numbers for which the analysis is to be performed.
- 5. Frequency (6E12.5 format)

Column	1-12 ^	13-24°	25-36	37-48	49-60	61-72
Name	FREQ(1)	FREQ(2)	FREQ(3)	FREQ(4)	FREQ(5)	FREQ(6)
Item	, , , , ,	n	,		,	n

- (1) FREQ Frequencies for which the analysis is to be performed. Continue on next card for FREQ(i) > 6
- 6. Deformation Modes. Repeat the following Cards NMODES Times

	(6112	) Format.				
Colúmn	1-12	13-24	25-36	37-48	49-60	61-72
Name	NTMl(i)	NFI		,		
Item	(1)	(2)		,,	v-	,

(1) NIMI(i) Number of deformation mode coefficients for the wing, mode i
 (2) NFI Compute generalize forces; 0~No, 1~Yes

If NFI = 0, the program will compute the VPIC's and stop,

Format 37-48 49-60 Column 13424 CØ(1)  $C\emptyset(2)$ CØ(3) CØ(4) CØ(5) CØ(6) Name (4) (5)Item (6)

(1) CØ(i) i = 1. NTM deformation polynomial coefficients to be input in the following order: 0,0; 1,0; 0,1; 2,9; 1,1; 0,2; 3,0; where the first integer is the power of x and the second is the power of y. Continue on successive card until all polynomial coefficients are input.

	(6112	Format				
Column	1-12	13-24	25-36	37-48	49-60	61-72
Name	NTM(1)	NPI.			,	
Įtem	(1)	(2)			٠	*

- (1) NTM2(i) Number of deformation mode coefficients for the control surface, mode (i)
- (2) NFI Compute generalized forces;  $0 \sim \text{No}$ ;  $1 \sim \text{Yes}$ . If NFI = 0, the program will compute the VPIC's and stop.

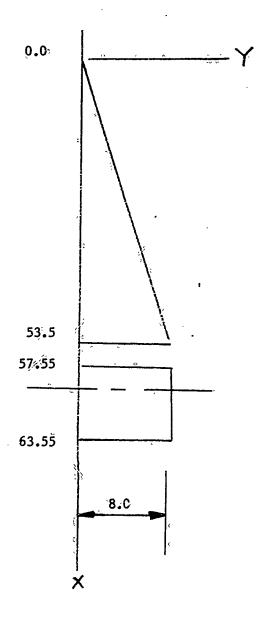
	(6E12/	5) Format		ene		
Column	1-12	13-24	∑ 25–36	37-48	49-60°	61-72
Name:	CØ(1)	CØ (2)	CØ(3)	CØ (4)	CØ(5)	CØ(6)
Item	(1)	(2)	(3)	(4)	(5)	.(6)

C%(i) i - 1, NTM deformation polynomial coefficients to be input in the following order; 0,0; 1,0; 0,1; 2,0; 1,1; 0,2; 3,0; etc. where the first integer is the power of "x" and the second is the power of "y". Continue on successive cards until all polynomial coefficients are input.

## 5.4 SAMPLE PROBLEM

The generalized forces are calculated for the configuration below. The flight parameters and pertinent input data are on the first page of the computer print out.

The coefficients of the deformation modes for the forward surface are shown on the third page of the computer print out, and for the aft surface on the fifth page of the computer print out.



# HAC/NAA MISSILE SUPERSONIC AIRLUADS PROGRAM

-

S profession is

Sperged M

S. COMMENT

STATISTICS IN

KANED .

## FLIGHT CONDITIONS AND GEOMETRY.

ΉΑC	MACH NUMBER	ਜ਼ੂਰ H	000005•	SPEED	ÛF	SOUNDS	SPEED OF SOUND = 13392.000 L/T	-RHD=0.11460000E-06
							ŶZII	TAIL
	L.E. STA	STATI	TION (L)	1		0	•	57.550
	ROOT CHO	CHORD	(L)			B B	ទីនី , ភពព្	00000
	L.E. SPA	SPAN	(F)			•	- •	100.9
	Ť.E. SPA	SPAN	(7)			Ø	000*8	Û00°,8
	TIP CHOR	gHORD	CF)			• 0	•	.Q 0 0 • 9
	TOTÁL ARI	LAREA	EA (L*L)			429	428.000	000.96
	CHORI	CHORDWISE	BOXES			4		•
	SPANNISE		BOXES				4	7

BUX SPAN = 1.21144E, 00

'80X CHORD \$4.1.35443€ 00 L

TOTAL CHORDWISE BOXES = 47

## MISSILE SUPERSUNIC AIRLOADS PRUGRAM (CONT'U)

```
AING, TAIL, AND DIAPHRAGH S.
(S) - WING S.
(S) - TAIL S.
(S) - TAIL S.
(A) - WAKE S.
(A) - WAKE S.
(A) - WAKE S.
```

```
35555.................
                                                                                                                                                35555
                                                                                                                                  88888
                                                                                                                                                               SSSS
                                                                                                                   $555555.................
                                                                                                            ........................
                                                                                                                                                                             SSSS---------
                                                                                                                                                                                    888888
                                                                                              SSSSS.........
                                                                                      $555.
                                                                               $SSS: .......
                                                                        35'S : . . . . . . . . . . . . . . . . .
                                                         555.....
                                  55.....
                     55.....
              55 ....
      ......
SŠ
```

555555........

2555555......

\$55555.....

5555555....

388888

\$5555E...

555555

5555555... 5555555...

.888888

\*

# MISSILE SUPERSONIC AIRLOADS PROGRAM (CONT'D)

on the house was a son bearing and some that of the

The state of

September 1

	OSCILLATORY FREGUENCY (CPS)	(EQUENÇY (CPS)	200.00000		47 BOXES IN C	CHORD DIRECTION	Z
`	REDUCED FREQUENCY	NCY (SERI CHORD)	RD) 1.67339	-	FREE STREAM H	ACH NUMBER	1,500
	œ	INPUT MODE REFERENCED TO THE	DE SHAPE POLYNI THE SURFACE LEI	NOPTAL CUEFFICE	HENTS FOR WINTERLINE	NO ERSECTION	
HODE		COEFFS.		-	-		,
਼ਜ	-2.7643E-03	-2.3968E-03	1.0698E-01	3.3227E-04	-1.7350E-02	-3.6455E-02	-2.0567E-05
	1.0242E-03	-1.5649E-03	2.5596E-02	5.4159E-07	-2.8255E-05	2.0969E-04	-1.7662E-03
	1.4567E-03	-4.8146E-09	2.6893E-07	3.0507E-06	2.2374E-05	-1.5766E-05	-2.0292E-05
<b>~</b>	5.4081E=04	1.1346E-02	-1.4269E-01	-3.9870E-03	1.7391E-02.	-5,2818E-02	1.2097E-04
	-2.0628E-03	3.7740E-02	-1.1759E-01	-2.9744E-06	7.7451E-05.	-1,5215E-03	4.6965E-03
	1.1664E-03	2.4952E-08	-8.3941E-07	1.0896E-05	-7.6407E-05.	2,3531E-04	-7.3812E-04
<b>19</b> ,	1.6687E-02	-1.9542E-02	-1.5043E 00.	3.1.005E-03	2.2035E-01	1.6944E±01	-1.9229E-04
	-9.0043E-03	-2.6816E-02	8.1504E-02	4.8204E-06	1.3340E-01	9.4618E=04	-2.3806E-03
	-7.3799E-03	-4.0844E-08	-5.5376E-07	-1.4601E-05	1.3599E-04	-9.1914E=04	3.1290E-03
4	1.3375E-01	-0.8015E-03	1.4319E 0U	3.0046E-03	-3.8145E-01	6.0607E-01	-2.9098E-04
	2.4713E+02	-1.2993E-01	3.2289E-01	9.6282E-06	-8.5727E-04	6.9968E-03	-3.3429E-02
	5.4256E+02	-9.6391E-08	8.2378E-06	-8.4006E-05	3.9512E-04	-1.0736E-04	-2.7726E-03
R3	-2.3479E-04	-5.1973E-03.	2.3344E-01	3.7865E-04	-3.3701E:04	-2.7195E-01	-6.471UE-06
	-8.1025E-04	1.3782E-02	5.794\$E-02	-4.9236E-08	2.7501E:05	-2.6211E-04	-1.5177E-03
	-5.3560E-03	1.3471E-09	-2.6464E-07	2.2137E-06	-1.5090E-08	1.5586E-04	-1.3277E-64

## 18 6 3. 14 14 14 14

## HISSICE SUPERSONIC AIRLUANS PROGRAM (CONTIN)

ī				_	
į		0ENER!	GENERALIZED FORCES FOR WING	N I AG	
בו ר	LOAD	REAL PART	IHAG 'PART	ÁRS VALUE	PHASE ANGLE
-	п	-4.053306-01	1.41647E-01	4,29367 <u>E</u> -01	160.737 DEG
<b></b> .	~	2.48826E 00	-2.46939E 00	3.505618 00	-44.782 DEG
-	ro,	5.69256E 0U	2.422536-01	5.69771E uu	2%437 DEU
-	•	-6.72883E 00	-1.33247E 00	6.6542E 200	-168,465 DEG
-	సా	3.05956E-01	-5.451146=02	3.69994E-01.	-8.472 DEG
~	-	5.42497E 00	1.01807E-01	5.4259JE 00	1.075 DEG
0	~	-1.13634E n2	5.50276E U1	1.26256E UZ	154-161 DEU
8	ю	-1,17337E 02	-9.03881E 01	1.48114E 02	-142,392 DEG
8	4	3.85767E :01	7.90880E 01	8.79948Ë 01	63.998 DEG
CI.	ξ <b>O</b>	-1.54986E 01	1.65535E 00	1.5586BE 01	173.984 DEG
w,	#1	-3.47591E 00	-4456201E 00	5.73532E 00	-127.385 DEU
n	8	4.30375E 01	5.025896 01	6.61678E 01	49.426 DEG
·W	ю	5.43115E ñi	1.55744E 02	1.64942E 02:	70.775 DEG
'n	₹	-8.58316E 01	-6;56561E 01	1.08064E 02	-142.586 DER
Ŕ	เก	2.34054E 01	9:49312E 00	2.525745 .ve	22.877 DEG
*	#1	3.10905E-01	4.44125E 00.	4.45212E 00	85.996 DEG
÷	Ň	-6.41152E 01	-8.88772E 90	6.47282E 01	-172-108 BEG
*	ň	-4.63360E 01	-1:24207E 02	1.32569E 02	-1/16.458, DEG
*	•	-3.63002E 01	8541059E-01	9,16052E 01	113.345 DEB
*	ĬG.	-1-47609E 01	-2.25630E 00	1'.49323E 01.	-171.389 DEC
ĸ	*1	-1.4528AE+01	-5.122846-02	1.54055E-01	-16#-577 DEG
æ	<b>≈</b> ,	-0.22063E 00	7.77921E '0ŭ	1.13179E 01	136,580 DEU
R)	p,	2.71663E >00	1.50198E 00	J.13366E 9U.	29.898' DEG
Ŕν	•	-1.62163E 01	3.835968 00	1.66638E AL	166.691 DEG
r)	ĸ	8.47165F-01	1.393156 00.	1.630518 00	58.697 NEG

# MASSILE SUPERSONIC AIRLUAUS PROGRAM (CONTID)

TOWNS TO STATE OF

The state of

FREE STREAM MACH NUMBER
SEMI CHORD) 1.67539
(SEMI CHOR
REDUCEN FREDUENCY

1.500

IMPUT MODE SHAPE POLYNOMIAL COEFFICIENTS FOR TAIL REFERENCED TO THE SURFACE LEADING EUGE-CENTERLINE INTERSECTION

## ## ## ## ## ## ## ## ## ## ## ## ##		3.9367E-03	2.6629E-03 6.8936E-05	1.4688E-03 2.3310E-05	2.0627E-03 6.3188E-04	1.4691E-02 1.7044E-04
## ## ## ## ## ## ## ## ## ## ## ## ##		8.2124E-03 2.1683E-04	5.6169E_03 9.4713E-06	5.2647E-05 5.1347E-05	3.7439E±84 9.9538E=05	2.2471E-0 1.6698E-0
### ### ### ### ### ### ### ### ### ##		2.5048E-0 3.6026E-0	.1856E-0	3.2752E-0 1.3279E-0	1.8417E-0 1.8412E-0	.0184E-0 .8190E-0
### ### ### ### ### #### #############		7.3360 5.0795	.7705E.	2614E-0 3103E-0	.2901E-0 .8345E-0	5.6429E-0 1.2591E-0
#05E 1		6.5782E-0 6.6256E-0	1.428UE-0 1.2652E-0	9.3449E-0 1.7027E-0	.6537E-0 .7425E-0	9.6235E-0 8.1679E-0
70 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	ဘ	.3922E±8 .5863E+8	1.8889E-U	2.5725E-0 7.2607E-0	6:4342E=0 8.0436E=0	3.1192E-0 2.7418E-0
9 <b>1</b>	-	2.9509E-0 1.4897E-0 1.5973E-0	5.2445E- 1.8634E- 9.1426E-	3.5644E-0 2.5833E-0 1.2438E-0	9.8849E=0 2.5576E=0 1.2428E=0	5.7341E-0 2.9503E-0 6.1575E-0
	110 X	Ħ	α.	, M	₹ 8	

## HISSILE SUPERSONIC AINLUAUS PROGRAM 4 CONS 10

47 BOXES IN CHORP DIRECTION	STREAM MACH NUMBER 1.500		ANS VALUE PHASI ANGLE	2./1895E UŽ 151.860 DEU	9.2723/E 61 67.854 BEG.	7.93060E 01 -170.132 DEG	1.84637E už -11.u58 DEG	7.39y05G u2 174,168 uEG	3.43021E   1   153.143 DEU	1.41767E.U1 73.593 UEQ	1:60443E Ul 177.789 UEU	3.07347E 01 -11.588 DEO	1.2515uE 02: 176.776 DEU	1.61874E 01 152.328 DEC	7.9au59E ou 78.224 DEG	1.07064E 01 .169:447 DEG	1.88022E Ul -14.917 DEG	6.27447E 01 178.572.DEC	8.68422E 01 -24.502 DEG	2.80854E'01 -115.188 UEG	4.72496E 01 6.397 DEU	8.67142E 91 162.56W DEG		2:76342E 02' -1.675 DEG	02 -1.675	02' -1.675 01 160.413 01 -75.018	02' -1.675 01 166-413 01 -75-018 01 -25-372	01 150.410 01 -25,072 01 157.618
47 BOXE	FREE ST	A TAIL	AIIS	2.71	12.6	1.93	1.84	9.39	6.43	1.41	1:60		1.25	1.61	196-2	1.07			9.8	2.80	4.72	6.67	74.6		90°4	# R R R	# # # # # # # # # # # # # # # # # # #	
201.000101	1.67539.	GENERALIZED FURCES FOR TAIL	IMAG "PART	1.241046 02	8.546311 01.	-1.35909F ul	-3.54137k 01.	9.55015E UI	1.54966E 01	1.359861.01	6.41368E-1)1	-6.17353E <00:	7.03793E 09	7.51749E 00	7.73430E 00	1.96083E 00	-4.84012E OR	1.563431 00	-3.60150E 01	-2.54166E 01	5.26476E 00	2,59885£ '0*	-8.07811E 00				3.06863E 00 -2.0461E 01, -2.80330E 01	
OŜCILLATORY FŘEQUENCY (CPS) 21	REDUCFO FREQUENCY (SEM1 CHORD)	GENE	REAL PART	-2.58915E 02	3.495416 01	-7.A132hE 01	1.41209E 02	**************************************	-3.06021E 01	4.00/29E 00.	-1.60314E 91	3. U1083E 01	-1.24952E 02	-1.43359E 01	11.61241E ·ÓU	-1.U5254E 01	1.816866 01	-6:27252E 01	7.90217E 01	-1-19493E 01	4.69554E 01	-8.27202E 01	2.76223E 02					
LLATORY	ICFO FRED		t, OAD	-	~	ю	•	r	-	~	ю	•	ĸ	<del>ja</del> r	ő	ю	4	Ń		∾:	ю	4	ĸċ		Ħ	₩ /0-	# -W- P3	# 40 B 4
0SC1	aedu		DEFL	#	-	ij	-	ŵ.	2	~	~	~	~	ю	ю	ю	ы	ıs	Ť	÷	4	•	*		ď	w w		

## MISSILE SUPERSONIC ATRLUAUS PROUBAM (CONT'D)

after and the contract of the

. .

A COM

Tarana and a second

JES FOR WING * 1A1L Paris						OENERALIZED FCRCES FOR WING * 1AIL	GENERALIZED FCRUES FOR WING * 1AIL	DENERALIZED FURES FOR MING 4 1411	DENERALIZED FURLES FOR WING * 1AIL	ENERALIZED FURUES FOR WING *		DENERAL CONTROLECTION OF 1411	GENERALÍZED FLRLES FOR MING *	DENERALIZED FURCES FOR WING * TAIL
								CT , AND MA MARKET MARK			DENERALIZED FURCES FOR WING * 1A1	TWI . SHIE WAS ABOUT A MERCHANISM		-
						THAG PART	THAG PART	THAG PART	IMAG PART	THAG PARTS		THAG PART	REAL PART THAG PART	THAG PARTS
16E 02 2.71517E	0.5°	0.5°		0.5°	0.5°	1.202461 02	02 1.PU246E 02	02 1.PU246E 02	02 1.PU246E 02	1.202461 02	02 1.PU246E 02	02 1.PU246E 02	02 1.PU246E 02	02 1.PU246E 02
17E 81 ' 9.14018F	. 10	. 10		. 10	. 10	8.341371: 01	0.1 8.341371: 0.1	0.1 8.341371: 0.1	0.1 8.341371: 0.1	8.341371: 01	0.1 8.341371: 0.1	0.1 8.341371: 0.1	0.1 8.341371: 0.1	0.1 8.341371: 0.1
ide 111 / . 36598E	=	=		=	=	-1.304868 11	01 -1.304666 11	01 -1.304666 11	01 -1.304666 11	-1.304868 11	01 -1.304666 11	01 -1.304666 11	01 -1.304666 11	01 -1.304666 11
12E 111 1.78504F	11	11		11	11	-3.6/462k 111	n2 -3.6/462k 111	n2 -3.6/462k 111	n2 -3.6/462k 111	-3.6/462k 111	n2 -3.6/462k 111	n2 -3.6/462k 111	n2 -3.6/462k 111	n2 -3.6/462k 111
10E 015 4.38535E	ر <b>د</b> ۵	ر <b>د</b> ۵		ر <b>د</b> ۵	ر <b>د</b> ۵	9.544701: 012	02 9.54470½ U1>	02 9.54470½ U1>	02 9.54470½ U1>	9.544701: 012	02 9.54470½ U1>	02 9.54470½ U1>	02 9.54470½ U1>	02 9.54470½ U1>
34E 015 2.96175E	015	015		015	015	1.55984E 015	01 1.55984E 01	01 1.55984E 01	01 1.55984E 01	1.55984E 015	01 1.55984E 01	01 1.55984E 01	01 1.55984E 01	01 1.55984E 01
116 01 1.29335E	01	01		01	01	6: \$6261E 01	02 6.86261E 01	02 6.86261E 01	02 6.86261E 01	6: \$6261E 01	02 6.86261E 01	02 6.86261E 01	02 6.86261E 01	02 6.86261E 01
1.60753E	0.1	0.1		0.1	0.1	-8.97468E 01	02 -8.974686 01	02 -8.974686 01	02 -8.974686 01	-8.97468E 01	02 -8.974686 01	02 -8.974686 01	02 -8.974686 01	02 -8.974686 01
15t 01 1.00171E	01.	01.		01.	01.	7.29145E 01	01 7.29145E 01	01 7.29145E 01	01 7.29145E 01	7.29145E 01	01 7.29145E 01	01 7.29145E 01	01 7.29145E 01	01 7.29145E 01
1.40719E	00	00	-	00	00	8.69328£ 00	02 8.69328E 00	02 8.69328E 00	02 8.69328E 00	8.69328£ 00	02 8.69328E 00	02 8.69328E 00	02 8.69328E 00	02 8.69328E 00
18E 00 1.80554E	. 00	. 00	,	. 00	. 00	2.95548E 00	01 2.95548E 00	01 2.95548E 00	01 2.95548E 00	2.95548E 00	01 2.95548E 00	01 2.95548E 00	01 2.95548E 00	01 2.95548E 00
12E 01 7.3190JE 01	01 7.3190JE	01 7.3190JE	7.31903E	01 7.3190JE	01 7.3190JE	5.79932E 01 7.3190JE	01 5.79932E 01 7.3190JE	01 5.79932E 01 7.3190JE	01 5.79932E 01 7.3190JE	5.79932E 01 7.3190JE	01 5.79932E 01 7.3190JE	01 5.79932E 01 7.3190JE	01 5.79932E 01 7.3190JE	01 5.79932E 01 7.3190JE
15E 02 1.63671E 02	02 1.63671E	02 1.63671E	1.63671E	02 1.63671E	02 1.63671E	1.57705E 02 1.63671E	01 1.57705E 02 1.63671E	01 1.57705E 02 1.63671E	01 1.57705E 02 1.63671E	1.57705E 02 1.63671E	01 1.57705E 02 1.63671E	01 1.57705E 02 1.63671E	01 1.57705E 02 1.63671E	01 1.57705E 02 1.63671E
, tů	, tů	, tů	, tů	, tů	, tů	-7.04962E ul	0.1 -7.04962E U.1	0.1 -7.04962E U.1	0.1 -7.04962E U.1	0.1 -7.04962F 01	0.1 -7.04962E 01	•		
<del>ن</del> د	ů,	T,	Į,	ů,	T O	-7.04962E 01	0.1 -7.04962E u.1	0.1 -7.04962E u.1	0.1 -7.04962E 0.1	0.1 -7.04962F ·b1	0.1 -7.04962E ul			
						•	•	•				0.1 -7.04962E 'U.1	0.1 -7.04962E 0.1	-7.04962E 01
				•								0.1 -7.04962E 0.1	0.1 -7.04962E 0.1	01 -7.04962E u1
												0.1 -7.04962E 0.1	0.1 -7.04962E 0.1	01 -7.04962E u1
o ė	a è	S ti	رة فر بريا	S ti	S E	1.57.03E 02 -7.04962E 01	0.1 -7.04962E 0.1	0.1 -7.04962E 0.1	0.1 -7.04962E 0.1	0.1 -7.04962E 0.1	0.1 -7.04962E 0.1	So 360//6.1	TO THE TANK	So acource of
-		-	-	-	-	8.69328E 2.95548E 5.79932E 1.57705E	02 8.69328E 01 2.95548E 01 9.79932E 01 1.57705E	02 8.69328E 01 2.95548E 01 9.79932E 01 1.57705E	02 8.69328E 01 2.95548E 01 5.79932E 01 1.57705E	02 8.69328E 01 2.95548E 01 5.79932E 01 1.57705E	02 8.69328E 01 2.95548E 01 5.79932E 01 1.57705E	02 8.69328E 01 2.95548E 01 5.79932E 01 1.57705E	02 8.69328E 01 2.95548E 01 3.779932E	02 8.69328E 01 2.95548E 01 5.79932E 01 1.57705E
<del>_</del>	•			•	•	1.5.7.0 4 6 6 E 1.5.7.7 9 9 3 2 E 1.5.7.7 9 9 3 2 E 1.7.0 4 9 6 E 1.7.	02 -0.97468E 01 7.29145E 02 8.69328E 01 2.95548E 01 1.57705E 01 -7.04962E	02 -0.97468E 01 7.29145E 02 8.69328E 01 2.95548E 01 1.57705E 01 -7.04962E	02 -0.97468E 01 7.29145E 01 2.95548E 01 5.7993E 01 1.57705E	02 0.02 0.02 0.02 0.00 0.00 0.00 0.00 0	02 0.02 0.02 0.02 0.02 0.02 0.02 0.03 0.03	02 -8.9745E 01 7.29145E 02 8.69328E 01 8.79932E 01 1.57705E	02 01 02 03 03 03 03 03 03 03 03 03 03 03 03 03	02 -8.9745E 01 7.29145E 02 8.69328E 01 8.79932E 01 1.57705E
	• • • • • • • • • • • • • • • • • • •	•		•		9.54470E 1.55984E 6.97468E 7.29145E 8.69328E 2.95548E 1.57705E	02 6.86261E 02 6.86261E 03 -8.9746E 01 7.29145E 02 8.69328E 03 2.95548E 01 1.57705E 01 -7.04962E	02 6.86261E 02 6.86261E 03 -8.9746E 01 7.29145E 02 8.69328E 03 2.95548E 01 1.57705E 01 -7.04962E	02 6.80201E 02 6.80201E 03 -8.97468E 01 7.29145E 02 8.69328E 03 2.95548E 01 7.9932E 01 1.57705E	02 6.86201E 02 6.86201E 03 7.29145E 01 7.29145E 01 8.69328E 01 8.79932E 01 1.87705E	02 6.\$6261E 02 6.\$6261E 03 7.29145E 01 7.29145E 01 8.69328E 01 8.79932E 01 1.57705E	02 6.36261E 02 6.36261E 02 -8.97468E 01 7.29145E 02 8.69328E 01 2.95548E 01 3.7795E	02 6.954470E 01 1.55984E 01 7.29145E 01 2.95548E 01 3.779932E	02 6.55984E 02 6.50201E 02 -6.97468E 01 7.29145E 02 8.69328E 01 2.95548E 01 5.79932E
	74016 74016	1.67470E 1.55984L 1.55984L 1.55984L 1.5970E 1.5970E 1.57705E	-3.6/462h 9.5447uh 1.55984h 6.96261h 7.29145h 8.69328h 8.69328h 8.69328h 1.57705h	-3.6/462h 9.54470h 1.55984b 6.86261b -8.9/468b 7.29145y 8.69328b 8.69328b 2.95548b 1.57705b	1.3.6/462h 1.559844 6.36261b 7.291454 7.291454 8.693286 8.693286 7.99328					1				
	3 4 3 7 4 7 9 7 9 9 9 7 4	3.0 411 3.0 411 3.0 414 3.0 41	6.8602 1.35044 1.35044 1.35044 1.3504 1.3	8.341. 1.304. 1.304. 1.502. 8.6933 1.5779 1.5779	1.2021 -1.3041 -3.6744 1.3599 -6.3602 -3.924 -7.291 1.37799 -7.049									

## 5.5 PROGRAM LISTING

```
SUP/0210
               FORTRAN NESTOUZDECK
               INCODE 18: F
                                                                                                                                                              SUP/0220
                                                                                                                                                              SUP 70230
CHRIY
                          DRIV
                                                                                                                                                              SUÉ/10245
             COMPLEX CZF: 0. VPIC.SS.DQ.Q.PHIW.SPHI.PHI.PHITE.OPHI.FXF
             GUMMONZCI/KHOX(2000),XF(5),YE(32:ASE3),X1,X2,X3,X4,Y1,Y2,BETA,NBS SUP7025U: 3
             COMMON/CZ/AS, WACH, FMACH(6), WEREQFFREG(10), NMODE, NSURF, LYPIC, LSSYPSUP/D260
            EUHMON/C3/C1 (111.28.2), NT (10.2), NF (10.2), NTHAX(2), PXY(28); FR(28)
                                                                                                                                                              SUP 7027 U
             СОМНОН/С4/VPT.(1275), SS(2000), NU(28,2), U(10,10,3), PHIN(50); SPHI
                                                                                                                                                              SUP/5050
             COMMON/C5/MOR(51), NRL(50) . KC(50), KL(20), BSL(20), DXE(71, TPI.U
                                                                                                                                                              SUP/0290
             CUMPLUNCO/X', A'Y' UX' UX' EH' EK' EKB' EKB' WE' WE' WBOX' KODF' WORE WAN WAS ENELLINED OF SON SON OF SON SON OF S
             COMMON/C7/C7FPO.PHI.PHITE.DPHI.AL.NS.NTH.K.J.OR.QI.UAJ.QAN.IFR.THLSUP/0310
                                                                                                                                                              SUP/0320
             COMMONICALRIO
                                                                                                                                                              SUP/M338
        A CALL DAIN
                                                                                                                                                              SUP/0340
             110 1000 MACHEL, MACH
                                                                                                                                                              SUP76350 °
             FM=1:MACHSMACH)
              IF (FM.LT.1.1) GO TO 1000
                                                                                                                                                              SUP7#360
                                                                                                                                                              SUP/いろŹU
             CALL COOL
                                                                                                                                                              SUP AUS 80 -
             TOB. = THL/BETA
                                                                                                                                                              SUP/6396.
             CALL POOP(1).
                                                                                                                                                              SUP/Ú4VÙ
             U = AS&FM
                                                                                                                                                              SUP/04120
             TPU = TRIVU
             REM= PX + (EM/+ FIA) + = 2
                                                                                                                                                              SUP20420
                                                                                                                                                              $0P70430
             HII YOU, IFR =14. NEREQ
             FK=FREO(IFR)*1P0
                                                                                                                                                              SIP/0440
                                                                                                                                                              SUP/11/454
             FKB = dFK#RF*
                                                                                                                                                              SUP/1/461
             EKR = FK* x1/2.6
                                                                                                                                                              $41P./ 047 U
             CALL CAFT
                                                                                                                                                              SUP/0480
             TEST VPIC-NE-B) CALL POUTES)
                                                                                                                                                              SHP/114911
             -VKU=EK*BX
             FXF=CMPLX(CUS(ARG))-SIN(ARG))
                                                                                                                                                              SHF/050.0
             no 500 NOBE=1.N400F
                                                                                                                                                             SUP/0510
                                                                                                                                                              SUP/0520
              DU 10 J=1:56
                                                                                                                                                              SUP/11531 <
       19 70(J;1)≈CZE≈0
                                                                                                                                                              SUP70540
              IF (NF (MUDE, 1). For. ) GO TO 210
                                                                                                                                                              SUP / 0550
              X=0.5+41X
                                                                                                                                                              SUP/0560
                                                                                                                                                              SUP 7.0570 4
              IF (LSSVP.NE.D) SALL PUUT (3)
                                                                                                                                                              °SUP7058u ∘
              DO 2011 NP=1; NEUX
                                                                                                                                                              SUP70590
              KD = KROX(NF)^2
                                                                                                                                                              $UP70600
              NS = 1
                                                                                                                                                              SUP70610
              GO 10 (70,61,70,61,61,70,70,70), KD
                                                                                                                                                              SUP/0620
     26 n NS = 2
             MB = MOB(NP)
                                                                                                                                                              SUP/0636
                                                                                                                                                              SUP70640
              Y = 0 - 0
                                                                                                                                                              SUP/6650
              no 100 MP=1,M9-
                                                                                                                                                              SUP/ปลัสป
              MP = MP
                                                                                                                                                              SUP70670
              KODI = KBDX (NE)
                                                                                                                                                              SUP/0680 1
              SPH1=CZERO
                                                                                                                                                              SUP/11691
              TE ( DP. GT. 1) CAPL PHILE
              SPHI=SPHI*DY
                                                                                                                                                              SUP/0700
                                                                                                                                                              SUP/0710
              #H1=CZFRU
              GO: 10 (40,40,40,40,40,20,30) KODE
                                                                                                                                                              SUP70720
                                                                                                                                                              SUP30730
       2n SPHI=SPHI-PLIM(4P)
                                                                                                                                                              SUP70740
              PHI=PHIW(4P)
              PHIR(MP)=PHLW(MP)*FXŘ
                                                                                                                                                              SUP/0750
                                                                                                                                                              SUP70760
              GO 10 50
                                                                                                                                                              SUP7677#5
       30 TF(KD.1-1-6) GO 10 40
                                                                                                                                                              ちゅりとしておりご
       50 SS(NB)=-SPHI/VPLC/DY
                                                                                                                                                              SUP 70790
              ğu 10 90
                                                                                                                                                              SUP 7 0 8th u
       411 CALL WASH
```

```
SUP70810
      SUP70820
      1F(KODE.GESA) GU TO 9U
                                                                            SUPADESU
     PHY=SPHI#SS(NB)#VPIC#DY
                                                                            SUP / 0849
      TF(KODE#E0.5% PHIN(MB)=PHIMEXE
                                                                            SUP7.085.03
      IFONE.EG.NBUX-17 PHINOMPD=PHI
      JY (NP.EQ.NBUX) OHITE=PHI+(PHI-PHIN(HP)) COXE(5)
                                                                            SUP70860
                                                                            SUP7/087/04
      CALF DOIT
  90 AFCHSSVP.NE.O) CALL PHUT (4)
                                                                            SUP/08800
                                                                            SUP/0890
     NB = NB + 1
                                                                            SUP70900
      KD = KODE
                                                                            SUP7.0910
 100 Y=Y+DY
 SUU X=X+DX
                                                                            SUP70920
 210 DO 400 MO =1, NM 106
                                                                            SUP7.0930
                                                                            SUP70.940c
      nő 300 ns=1; nsuxf
                                                                            SUP 7/1950
      n(MUDE, MO, NS)≈CZEKO
                                                                            SUP/0960
      NIM=NTCMO, NSA
                                                                            SUP70970
      DU 500 N=1,:T4
 30n Q(MODE, MD, NS)=Q(MODE, MO, NS)+CÔXMO, N5 NS)*DQ(N, NS)>
                                                                            SUP70980
     D(MIDF,MO,3) = GZ-R(I)
                                                                            SUPYUYYU
 400°Q(MODE,MO,3)≐n(MO)E,MO;1)+Q(MODE,MO;2)
                                                                            SUP/1000
 SUN CONTINUE
                                                                            SUP/1at1a
      DE = 2.0#DX*DY**HU
                                                                            SUP71020
     no 800 NS=1.3.
                                                                            SUP /1830
      CALL POUT(6)
                                                                            SUP71040
      DO 700 J=1.5 MODE
                                                                            SUP71050
                                                                            SUP71:060
     :BO 700 K=1, MADE
                                                                            SUP/1070
     TOR = UF *KEAT (I)(K, J, NS) 7
                                                                            SUP/1080
      QÌ = UF*AIM>C(n(K,J,NS/))
      QAR=SURI(UI*01+0R*0F5
                                                                            SUP/1098
                                                                            SUP 7.1100
      RAN=0.0
      IF (DAB. NE. D. HA HA H-57.29578 #ALAN2 (QI, GR.)
                                                                            SUP/11110
                                                                            SUP/11/20
 JUH CALL POUT (7)
                                                                            SUP/1130
      JF(NSURF. EQ. 1) 40 TH 900
 BUO CONTINUE
                                                                            SUP71140
 900 CONTIMUE
                                                                            SUP71150.
1000 CUNTINUE
                                                                            SUP 71160
      60: TO 1
                                                                            SUP/1170
                                                                            SUP71180
      FND
       FORTRAN NESTHU, DECK
$
                                                                            SUP/1190
       INCORE
              lĥrF
                                                                            SUP71200
¢
CHAIN
            DA-IN
                                                                            SUP71210
      SUBLOUTINE HATN
                                                                            SUP71220
      COMMON/C1/KMOX G/OMOD; XE (5); Y.É (3); AR (3); X1; X2; X3; X4; Y1; Y2; BE(A; NBS SUP71230
      COMMON/CZ/AS, MMACH, FMACH(67, NFREQ, FREC(4A)), NMODE, NSURF, LVPIC, LSSVPSUP/124U
      @UMNON/@3/@0(18,23,2);NT(10,2),NF(10,2);NTMAX(2),PXY(28),FN(28)
                                                                            SUP71250
      ÇOMMON/C6/X,Y,NX,UY,FM,EK,EKB,EKR,NP,MP,NB,NBOX,KODE,MODE,NQ≦;NBT SUP7126⊕
      COMMON/C8/RHO
                                                                            SUP71270
      READ (5, 11) (XF(1), [=1,5)
                                                                            SUP/1280
      REAU(5,11) (YE(1),1=1,3),AS;RHO
                                                                            SUP71290
      RHO = RHO/1980.0
                                                                            SUP/1300
      READ (5,12) MACHS NERED, NHODE, NBW, LVPIC, LSSVP
                                                                             SUP/1310
      REATILES, 11) (FMACH(I) AG=1, NMACH)
                                                                             SUP / 1320
      READ (5,其1) (FREJOL), 1月1,NFREQ)
                                                                             SUP71330
      NSUPF≐®
                                                                             SUP71340
      IF(XE(4).LP.XE(5)) GO TO 10
                                                                            SUP/1350
                                                                            SUP/11360
      NSURF=1
                                                                            SUP71370
      XE (4)=XE(3)
                                                                            SUP71380
      XF (5/)=XE(3)
   10 NEMAX(1)=0.
                                                                            SUP/1390
                                                                            SUP71490
      0 = (S) \times MTM
```

```
BO 30 MODE=1,4MaDE
                                                                                                                                          SUP71410
           DO SO I=1.NOURF
                                                                                                                                          SUP71420
           DC 20 J=1,2%
                                                                                                                                          SUP7143U
     20 COGMODF, J, 1) = 11.1
                                                                                                                                          SUP71440
           RFAD(5,12) TH, NFI
                                                                                                                                          SUP71450
           NI(MODE, I) = IM
                                                                                                                                          SUP71760
           NTMAX(T) = MAXN(NTMAX(T), NTM)
                                                                                                                                          SUP71470
           NF(MOBE, I)=FI
                                                                                                                                          SUP71480
     SU REMARCO, 11) (COCHODE, J, L), J=1, NTM)
                                                                                                                                          SUP71490
     11 FURMAT(6E12.8)
                                                                                                                                          SUP71500
     12 FURMAT (61:123)
                                                                                                                                          SUP71510
           RETURN
                                                                                                                                          SUP71521
           END
                                                                                                                                         SUP71530
             FORTRAN NESTOULDECK
                                                                                                                                          SUP70030
             INCODE
                           IRME
                                                                                                                                          SUP70040
CCCNS
                      CHNS
                                                                                                                                          $UP70050
           BLOCK DATA
                                                                                                                                          SUP70060
           COMPLEX CZEPO, VPCC, SS, NO, O, PHIW, SPHI, PHI, PHITE, UPHI
                                                                                                                                          SUP70070
           60MM0N/C3/Cu(10,2x,2),NT(10,2),NF(10,2);NTMAX(2),PXY(28},FN(28)
                                                                                                                                         SUPTOUSU
           COMMON/C4/YPIC(1275).SS(2000).DG(28.2).Q(10.10.3).PHIW(50).SPHI
                                                                                                                                          SUP /5050
           CUMMON/C5/MUR(50), NBE(50), KC(50), KL(28), BSE(20), DXE(7), LPL, U
                                                                                                                                          SUP70100
           COMMON/C7/C2FPG, PHI, PHITE, DPHI, XL, NS, NTH, K, J, QR, QT, QAB, QAN, IFR, THESUP/ULTU
           COMPONZESZRPO
                                                                                                                                          SUP70120 >
           MATA KC/1,2,4,7,11,16,22,29,37,46,56,67,79,92,106,121,137,154,172,SUP7U13u
         1194,2115232,254,2/7,301,326,352,379,407,436,466,497,529,562,596,
                                                                                                                                          SUP76140
         2631,667,704,742,781,821,862,904,947,991,1036,1082,1129,1177,1226A,SUP/0150
         SUP70160 د. فاره 1 د. فرو 3 د و 4 د و 5 رو 9 د و 1 رو 2 د و 3 ترو 4 د و 1 د و 5 د و 6 د و 1 د و 5 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و 1 د و
         4 6.,5.,4.,3.,2.,1.,u./,TPI/6.2831853/,CZERO/(C.U.U.O.O)/
                                                                                                                                         SUP70170
           DATA KLK1.1 14:2.3.1, 4.5.6.1.7.8.9.10.1.1.1.1.1.1.1.1.1.1.3.1.6.1.1.6.1.1.4.5.6.1.4.5.1.1.1.1.1.1.1.1.1.1.1.1
         1 19,20,21,1/
                                                                                                                                          SUP 70190
           FND
                                                                                                                                          SUP70200
             FORTRAN NESTUUS DECK
                                                                                                                                          SUP/1540
             INCODE IBME
                                                                                                                                         SUP71550 3
CCODE
                       CODE
                                                                                                                                          SUP 71560
           SURKOUTINE CORE
                                                                                                                                          SUP/1570
           COMPLEX CZEGO;VPIC;$S,DO;@,PHIW,SPRI;PHI,PRITE;0PHI
                                                                                                                                          SUP71580
           COMMON/C1/KFOX(2000),XF(5),YE(3),AR(3),X1,X2,X3,X4,Y1,Y2,BETA,NBS SUP/1590
           COMMON/C2/A', MMACH, FMACH(6), NFREQ, FREG(10), NMODE, NSURF, LVPIC, LSSVPSUP/1600
           COMMON/C3/C:(10,28,20),NT(10,2),NF(10,2),NTMAX(2),PXY(28),FN(28)
                                                                                                                                          SUP/1610
           COMPON/C4/VPTC(12/5)>SS(2000),DU(28,2),Q(10,10;3),PHTW(50),SPHI
                                                                                                                                          SUP75050
           CUMNON/U5/MU9(54)/NHL(50)/KC(50)/KL(28)/BSL(2u)/DXE(7)/TPI/U
                                                                                                                                          SUP7163m
           COMFOR/C6/X.Y.DX.JY.EM.FK.EKB.EKR.NP.MP.NB.NBOX.KODE.MODE.NBW.NBT SUP7.1640
           COMEON/C7/C2Fe0, Pol, PHITE, DPHI, XL, NS, NTM, K, J, OR, OL, GABS UAN, IFR, IWLSOP#1650
           COMMON/CS/RHO
                                                                                                                                          SUP/1661
           BETA = SORT(\emptyset FM + FM)-1.0)
                                                                                                                                          SUP71670
           x1 = xF(3) - xF(1)
                                                                                                                                          SUP74680 >
           x2 = xE(3) - xF(2)
                                                                                                                                          SUP71690
           x3 = xE(4) \leftarrow xF(1)
                                                                                                                                         SUP71700
           x4 = xF(5) + xF(4)
                                                                                                                                          SUP71710
           X5 = XE(5) - \hat{X}E(1)
                                                                                                                                          SUP71721
           Y\hat{1} = YE(2) - YE(\hat{1})
                                                                                                                                          SUR71730
           Y2 = YF(3) - YF(1)
                                                                                                                                         SUP.71740
            IF(X2.G1.X1.OR.X1.G1.X3.OR.X3.G1.X5.OK.X2.L1.U.U) GO TÚ 5U
                                                                                                                                          SUP/1750
                                                                                                                                          SUP/1760
            IF (Y1.GT.Y2.0x.Y1.L1.0.0) GU TO 50
                                                                                                                                          SUP7/1770
            TWI = 0.0
                                      T+I = (X1 - X2) / ((Y2 - Y1))
                                                                                                                                          SUP/1780
            IF (Y2.Nt.Y1)
                                                                                                                                         SUP/1790
                                      (72*(X2+X1) - Y1 * (X2-X1))
           AR(1) =
                                                                                                                                          SUP71800
           \Delta R(2) = Y2**4*2.0
                                                                                                                                          SUP/71810
           \Delta R(3) = \Delta R(1) + \Delta R(2)
                                                                                                                                          SUP71828
      10 DX = X\$/(FL(AT(1BN) - 0.5)
```

90

```
IF (50.0 * HX .GT. X5) GO TO 20:
                                                                             SUP71838
  15 NBW = NBW-1
                                                                             SUP71840
                                                                             SUP71850
      GO TO 10
                                                                             SUP71860
  20 \text{ DY} = DX/8ETA
                                                                             SUP71870
      YN1 = Y1/NY
                                                                             SUP71880
      YN2 = Y2/BY
                                                                             SUP71890
      XNL = YN2 - (X1-X2) / DX
      XNT = YN2 + X5/JX
                                                                             SUP71900
      XNLE = X3/DX
                                                                             SUP71910
                                                                             SUP/1920
      XNTF=X5/DX
      NBOX=XNTE+0.5
                                                                             SUP71930
      NBS = Y2/DY + 1.0
                                                                             SUP71940
                                                                             SUP71950
      NBT = X4/DX + 0.5
      UXF(1) = 4.0
                                                                             SUP/1960
      BXF(2) = 1.0
                                                                             SUP71970
                                                                             SUP71980
      カXF(3) = り。5
                                                                             SUP71990
      DXF(4) = AINT(XxLE + 1.5) - XNLE
                                                                             SUP72000
      DXF(5)=XNIE=FigaT(NBOX-1)
                                                                             SUP72010.
      ክxF(ճ) ≒ ሀ.።
                                                                             SUP 72020
      BXE(79) = 0.8
      x = 0.5 * Dx
                                                                             SUP / 2030
      NB = 0
                                                                             SUP72640
      BU 4.0 NP = 1, NBUX
                                                                             SUP72050
      XN = FLUAT(NP) - 0.5
                                                                             SUP/2060
                                                                             SUP72070
      YW = YN2
                                                                             SUP/2080
        (THL .GT. 0.0) YH=AMIN1(YH;YN1+XN/(TWE/BETA))
      IF(X.GI.XE(2)) 66 TO 24
                                                                             SUP72090
                                                                             SUP/72100
      MB = MIN1(AMAX1(YW,XN+YN1),XNT-XN)+1
      GO 10 28
                                                                             SUP72110
   24 MB = MIN1(AmAX1(XHL+XN,XM+YN1),XN3-XN)+1
                                                                             SUP72120
   28 MOB (NP) = MA
                                                                             SUP7213U
                                                                             SUP/2140
      KODE = 1
      IF (NP .EQ. NBH) KODE =3
                                                                             SUP72150
                                                                             SUP72160
         (NSURF .FQ.1) 60 TO 29
      IF (X \cdot G) ×1) KODE =6
                                                                             SÚP72170
        (X .GT. x3
                      ) KODE =4
                                                                             SUP72180
      LF
      IF (X .GT. x3+Dx) KODE=2
                                                                             SUP72190
                                                                             SUP72200
      IF (NP .Eu. NBOX) KODE =5
  29 IF(NB+MB+GT-2000) GO TO 15
                                                                             SUP/2210
                                                                             SUP72220
      MBI(NP) = NF
      DO 30 MP = 1, MR
                                                                             SUP72230
                                                                             SUP72240
      YN = MP-1
      NB_2 = NB + 1
                                                                             SUP72250
      IF (YN .GT. YW) KUDE =7
                                                                             SUP/2260
   30 KBOX (NB
                  ) = KOUE
                                                                             SUP72270
                                                                             SUP72280
   48 X = X+BX
      RETURN
                                                                              SUP72290
   50 CALL EXIT
                                                                             SUP/23111
      RETURN
                                                                             SUP72310
      FND
                                                                             SUP / 232 ii
       FORTRAN NESTOU.DECK
                                                                             SUP7233a
       INCODE IBUF
                                                                             SUP72340
            CAEL
CCAFI
                                                                             SUP72350
      SUBROUTINE CAFI
                                                                             SUP72360
      complex czero, vpic,ss, no, a, PHIW, sphi, phi, phile, ophi.
                                                                             SUP/2378
      DIMENSION P(5), w(5)
                                                                             SUP72380.
      COMMON/C4/VPIC(1275),SS(2000),DQ(28%2),Q(10,10,3),PHIW(50),SPHI
                                                                             SUP75050
      COMMON/C5/MOB(5%),NBL(50),KC(50%),KL(28),BSL(2u),DXE(7),TPI,U
                                                                             SUP/240u
      COMMON/CE/X-1.DX.D1.EW.EW.EKB.EKB.NP.KP.NR.MBDX.KODE.MODE.NRM.NRT SUP72410
```

COMMON/C7/CZERO,PHI,PHITESBPHI,XL,NS,NTM,K,j,UR,QI,QAB,QAN,IFR,TWLSUP72420

```
COMMON/C8/RHO
                                                                            SUP.72430
   DATA P/0.95308992,0.76923465,0.5,0.23076535,1.34691808/
                                                                            SUP7244Ŭ
                                                                            SUP72450
     , y/0.11646344,0.23931434,0.28444444,0.23931434,0.11846344/
                                                                            SUP72460
   PI = TPI/2.0
                                                                            SUP72478
   IF (FKB.GT.0.0) GO TO 10
   VPIC = (-1.0,0.0)
                                                                            SUP72480
                                                                            SUP72490
   GO-10 30
                                                                            SUP72500
10 YPIC = CZERO
                                                                            SUP72510
   no 20 I = 1,5
                                                                            SUP72520
   ARG = EKB+P(1)/2:0
                                                                            SUP72530
   F = -(0.5*ARG/Ed)**2
   7J = 1.0
                                                                            SUP72540
                                                                            SUP7.2550
   FI = 1.0
                                                                            SUP72560
      = 1.0
   AE
   10 15 K = 1.20
                                                                            SÜP/2570
      = AE * F/EI**2
                                                                            SUP72580
   AE
   FI = FI + 1.0
                                                                            SUP72590
   IF(ABS(AE).IF.1.E-5) GO TO 20
                                                                            SUP72600
15 7J = ZJ + ÅE
                                                                            SUP72610
2n vPiS = VPIC - 79*4(1)*CHPLX(COS(ARG),-SIN(ARG))
                                                                            SUP72620
                                                                            SUP72630
30 00 80 NP = 2.080X
                                                                            SUP7264,0
   KI = KC(NP)
   KZ = KC(NP+1) - 1
                                                                            SUP7265#
                                                                            SUP72660
   PD/40 K = K1, KZ
4\pi \text{ VPIC(K)} = \text{CZFRO}
                                                                            SUP72670
   NU = NP - 1
                                                                            SUP72680
   District | = 1,5
                                                                            SUP72694
   x = FLOAT(N=) - 0.5 + P(I)
                                                                            SUP72700
                                                                            SUP/2716
   VBC = EKB*X
                                                                            SUP/2721
   RHT = W(F) * CMPE x(-CUS(ARG), SIN(ARG)) * 2.0/PI
                                                                            SUP72731
   CALL BSLS (ARG/FAM)
   K = KC(NP)
                                                                            SUP7274L
   DO 70 MP = 1,NU
                                                                            SÚP7275 i
                                                                            SUP72761
   :EOX = (FLOA1(dP) → 0.50/X
                                                                            SUP7.2771
   C = SQRT(1.0 - E0x**2)
   AF = 2.0 + ATAN(E)X/(1.0 + C)
                                                                            SUP72781
                                                                            SUP72791
   s = 2.0*F0X*C
                                                                            SUP72801
   c = 2.0*c*c - 1.0
                                                                            SÚP7281)
   SU = 0.0
                                                                            SÚP7282
   VIN = BSL+Af
                                                                            SUP7283
   F = 1.0
                                                                            SUP7284
   FI = 1.0
                                                                            SUP/285
   p0.50 L = 1.N
   VIN = BSE(L+L)*S/FT - VIN
                                                                            SUP7286
   SN = 2.0*S*C - S0
                                                                            SUP7287
   S0 = S
                                                                            SUP7288
                                                                            SUP72891
   S = SN
                                                                            SUP72901
   'F = -F
50 FI = FI + 1.0
                                                                            SUP7291
                                                                            SUP7292
   DPHI = BHE*VIN*F
   VPIC(K) = VPIC(K) + DPHI
                                                                            SUP7293
   VPIC(K+1) = VPIC(K+1) - DPHI
                                                                            SUP7294
   IF (MP.EQ.1) VPIC(K) = VPIC(K) + DPHI
                                                                            SUP7295
                                                                            SUP7296
70 \text{ K} = \text{K} + \text{1}^{\circ}
80 VPIC(K) = VPIC(K) +PI*BSL*PHI/2.0
                                                                            SUP7297
                                                                            SUP7298
   RETURN
                                                                            SUP7299
   FND:
                                                                            SUP7300
    FORTRAN NESTHU, DECK
    INCOOF IR: F
                                                                            SUP/301
```

BSLS

CHSUS

SUP 7302

```
SUP73030
      SUBBRUUTINE WSLS(ARG)N)
                                                                              SUP73040
      ∵COHHON/C5/HOB(50),RBL(50),KC(50),KL(28),BSL(20;₽9XE(7),TPI,U
                                                                              SUP73050
      COMPON/C8/REG
           I=1,200
      DO. 1
                                                                              SUP73060
    1 BSI(I) = 0.0
                                                                              SUP73070
      ASO = ARG**2
                                                                              SUP73080
                                                                              SUP73090
      ÌF(ASU.LT.0:01) GO TO 50
                                                                              SUP73100
      N = MIN1(17.0, (ARG + 10.0))
                                                                              SUP73118
      BSI (N+2)^{2} = (4.0*f*(f+1.0))/ASO*(f-1.0)/f)*0.3E+30
                                                                             SUP73124
                                                                             SUP73138
      PF = 0.0
      J = 0
                                                                             SUP73140
                                                                             SUP73150
     - NO 10 I = J,N
                                                                             SUP73160
      H = N - \frac{1}{2} + 1
      F = 2*M + 1
                                                                             SUP73170
      RSL(H)=(4.0*(F-1.0)/ASQ-1.0/F-1.0/(F-2.0))*BSL(H+1)-BSL(H+2)/F
                                                                             SUP73180
   10 PF = PF + 2*0*(P+2*0)*BSL(H+1)
                                                                             SUP73190
                                                                             SUP73200
      PF = 'PF + BSL(1")
      F = 0.0
                                                                             SUP73210
                                                                             SUP7322U
      IF(ABS(PF).GT.1.8)
                           F = ABS(PF) *1.E-10
                                                                             SUP73230
                                                                             SUP73240
      no 30 L = 1, N
                                                                              SUP73250
      IF(F.GE.ABS(BSL(I))) GO: TO 20
                                                                              SUP73260
      BSL(I) = BSL(I)/PF
                                                                              SUP73270
      GO 10:.30
   20 ASL(1) = 0.0
                                                                              SUP73280
   30 CONTINUE
                                                                              SUP73290
                                                                              SUP73300
      DO 40 I = 1.N
      IF(ABS(BSL(N)).GT.1.0 E-7) REJURN
                                                                              SUP73310
                                                                              SUP73320
   4n n = n - 1
                                                                              SUP/3330
      RETURN
   50 BSL (2) = 0.125*ASU
                                                                              SUP/3340
      BSL(1) = 1.0 - 2.0*BSL(2)
                                                                              SUP73350
      N = 2
                                                                              SUP73360
                                                                              SUP733.70
      RETURN
                                                                              SUP7338Ù
      END
       FORTRAN NESTOU, DECK
                                                                             SUP73390
       INCÔDE
               TBMF
                                                                             SUP73400
$
CARLE
            AREE
                                                                              SUP73410
      FUNCTION ARLE(TOB)
                                                                              SUP73420
      COMMON/C1/KHOX(2000),xF(5),YE(3),AR(3),X1,X2,X3,X4,Y1,Y2,BETA,NBS SUP73430
      COMMON/CO/X.Y.DX.NY.EM.EK.EKB.EKR.NP.PP.NB.NBOX.KODE.MODE.NBW.NBT SUP73440
                                                                              SUR73450
      COMMON/C8/RHO
                                                                              SUP73460
      IF (-X-0.5*DX.GE.X1-X2) GO TO 10
      YT = (Y-Y1) \times 0.9 + 0.5 - (X/DX-0.5)/TUB
                                                                              SUP/3476
                                                                              SUP73480
      XR = YI*TOB
      YB = AMAX1(0.0, AMIN1(1.0, YT-1.0/TOB))
                                                                              SUP73490
                                                                              SUP/3500
      YF = AMINI(1.0.3MAX1(0.0.YT))
      XL = AMAX1(0.05AMSN1(1.0,XR-TOB))
                                                                              SUP/3510
      XR = AMIN1(10.0, AMXX1(0.0, XR))
                                                                              SUP/3520
      ARLE = AMAX1(n.5*(YT*(XR+XL)+YB*(XR-XL)),0.0)
                                                                              SUP73530
      IF(MP.EQ.1) ARLE = 2.0*ARLE
                                                                              SUP/3540
      RETURN
                                                                              SUP73550
   10 ARLF = AMINA(T.U,AMAXE(0.0,(Y-Y2)/DY+0.5))
                                                                              SUP73560-
                                                                              SUP73570
      RETURN
                                                                              SUP/3580
      FND
                                                                              SUP/3590
       FORTRAN NESTOU. DECK
                                                                              SUP/3600
       PMCONF
               1B+F.
                                                                              SUP73610
CPHIR
           ં ઇતિષ્
                                                                              SUP73620
      SURKOUTINE KHIB
                                           93
```

```
SUP73630
      COMPLEX CZEKO, VPIC, SS, DQ, Q, PHIW, SPHI, PHI, PHITE, DPHI
                                                                              SUP75050
      COMMON/C4/YFIC(1275),SS(2000),DQ(28,2),Q(10,19,3),PHIH(50),SPHI
      COMMON/C5/MOB(50), NBL(50), KC(50), KL(28), BSL(28), DXE(7), TPI, U
                                                                              SUP73650
      COMMON/C6/X,Y,DX,DY,EM,EK,EKB;EKR,NP,NP,NB,NBOX,KODE,MODE;NBN,NBT SUP7366U
      COMMON/C7/CZERO, PHI, PHITE, DPHI, XL, NS, NTM, K, J, QR, QI, QAB, QAN, 1FR, THLSUP73670
                                                                              SUP/3680
      COMMON/C8/RHO
                                                                              SUP73690
      DO 20 1=2.NP
                                                                              SUP737.00
      NU=NP-1+1.
                                                                              SUP73710
      JL=HAXO(1,HP-[+1/)
                                                                              SUP73720
      JR=MINO(MOB(NU), MP+I-1)
                                                                              SUP73730
      NU=NBL(NU)+JL
                                                                              SUP/3740
      no 20 J=JL,JR
                                                                              SUP/3750
      K=KC(I)+IABS(MP-J)
      DPH1=VPIC(K)
                                                                              SUP73760
                                                                              SUP 73770
      IF (J.GT.1-NP+1.OR.J.EQ.1) GO TO 10
                                                                              SUP/3780
      K = KC(I) + MP + J - 2
      DPHI=DPHI+VPIC(K)
                                                                              SUP73790
   In SPHI=SPHI+DRHI*SS(NJ)
                                                                              SUP73800
                                                                              SUP/3810
   20: NJ=NJ+1
                                                                              SUP73820
      REÎURN
      END
                                                                              SUP73830
                                                                              SUP/3840
       FORTRAN NESTBUJDECK
                                                                              SUP73850
       INCODE
                THE
                                                                              SUP73860
CDC.LJ.
             nulj
      SUBROUTINE BOIJ
                                                                              SUP73870
      COMPLEX CZEKO, VPIC, SS, DO, J, PHIN, SPHI, PHI, PHITE, DPHI
                                                                              SUP73880
      COMMON/C1/KEGX(2000),XE(5);YE(3),AR(3),X1,X2,X3,X4,Y1,Y2,BETA,NBS SUP73890
                                                                              SUP73900
      COMMON/C3/CU(10,28,2),N1(10,2),NF(10,2),NTMAX(2);PXY(28),FN(28)
                                                                              SUP75050
      COMMON/C4/VPIC(1275).SS(2000).BQ(28,2).Q(10,10,3).PHIW(50).SPHI
                                                                              SUP73920
      COMMON/C5/MOB(5U),NBL(50),KC(50),KL(28),BSL(20),DXE(7),TPI,U
      COMMON/C6/X,Y;DX,DY,EM;EK,EKB,EKR,NP,HP;NB,NBOX;KODE,MODE,NBH,NBT SUP7393U
      COMMON/C7/CZERO, PHI, PHITE, DPHI, XL, NS, NTM, K, J, QR, QL, QAB, QAN, IFR, THLSUP73940
                                                                              SUP73959
      COMMON/C8/RHO
      NTM = NTMAX(NS')
                                                                              SUP 73960
                                                                              SUP73970
      DPHI=PHI
                                                                              SUR73980
      IF (MP.FU.1) DPHI=U.5*OPHI
                                                                              SUP73990
      COB = U*DXE(Kabe)
                                                                              SUP74000
      no 20 K=1;Nim
                                                                              SUP74010
      KK=NL(K)
   2n no(k, ns) = +o(k, ns) + nPHI*CON*CMPLX(PXY(KK)*ENCK);-EK*PXY(K);
                                                                              SUP74020
      IF(KOBF.NE.4) GO 10 50
                                                                              SUP74030
      BO 30 K = 1,NTM
                                                                              SUP74040
   3m pq(K,1) = Dr(K,1) - H*DPHI*PXŶ(K)/DX
                                                                              SUP74050
                                                                              SUP74060
      ARG = FK*(X3 - X1)
                                                                              SUP74070
      DPHI = -DPHI*CMPL*(COS(ARG); -SIN(ARG))
                                                                              SUP74080
      XL = 0.0
      CALL DEGE
                                                                              SUP74090
                                                                              SUP74100
   50 TF(KODE.NE.5) RETURN
                                                                              SUP74110
      XL = X4
      IF(MP.EU.1)PHATE = 0.5*PHITE
                                                                              SUP/4120
      BPHT = PHITE
                                                                              SUP74130
      CALL DEGE
                                                                              SUP7414U
      RETURN
                                                                              SUP74150
                                                                              SUP/4160
      END.
                                                                              SUP74170
       FORTRAN NLSTUU, DECK
                                                                              SUP74180
       INCODE IBMF
                                                                              SUP74190
             QEGE
COEGE
                                                                              SUP74200.
      SUBROUTINE DEGE
                                                                              SUP74210
      COMPLEX CZERO, VPIG, SS, DOS ELEPHIN, SPHI, PHI, PHITE, DPHI
      COMMON/C4/VPIC(12/5), SS(2000), DQ(28,2),Q(10,10,3), PHIW(50), SPHI
                                                                              SUP 75 05 0
```

\$

```
CONHON/C5/HOB(50),NBL(50),KC(50),KL(28),BSL(20),DXE(7);(PI,U
                                                                               SUP74230
      CONHON/C6/X,Y,DX,UY,EH,EK,EKB,EKR,NP,MP,NB,NBOX,KODE,NODE,NBN,NBT SUP74240-
      COMMON/C7/CZERO,PHI,PHITE,DPHI,XE;NS,NTH,K,J,QR,QI,QAB,QAN,IFR,TWLSUP74250
      COMMON/C8/REG
                                                                               SUP74260
      PX=1.0/DX
                                                                               SUP7427.0
      IF (XL.E0.0.0°)
                       60 TO 30
                                                                               SUP74280
                                                                               SUP74290
      YX=Y/XL
                                                                               SUP74300.
      X=1
      DO 20 N=1,7
                                                                               SUP74310
      PY=PX
                                                                               SUP74320
      DO 10 H=1,N
                                                                               SUP74330
                                                                               SUP74340
      DQ(K,2) = DQ(K,2) -U*DPHI*PY
      IF(K.EQ.NTM) RETURN
                                                                               SUP74350
      K=K+1
                                                                               SUP7436U
   10 PY=PY*YX
                                                                               SUP 74370°
   2n PX=PX*XL
                                                                               SUP.74380.
                                                                               SUP/4390
      RETURN
   งก k=n
                                                                               SUP 74400
      DO 40 N=1.07
                                                                               SUP/441 U.
     : K=K+N
                                                                               SUP74420
      IF(K.GT.NTM) RĚTURN
                                                                               SUP7443U
      Nu(K,2) = Bo(K,2) -U*BPHI*PX
                                                                               SUP 7444 u
   40 PX=PX*Y
                                                                               SUP74450
      RETURN
                                                                               SUP74460
      END.
                                                                               SUP74470
                                                                               SUP74480
       FORTRAN NESTOU-DECK
       INCODE
               IBHE
                                                                               SUP74490%
CHASH
             WASH
                                                                               SUP/4500
      SUBFOUTINE WASH
                                                                               SUP74510
      COMPLEX CZERÓ, VPIC, SS, DO, Q, PHIW, SPHI, PHI, PHLTE, DPHI
                                                                               SUP 7452 U
      CUMMON/C1/K40X(2000),XE(5),YE(3),AR(3),X1,X2,X3,X4,Y1,Y2,BETA,NBS
                                                                              SUP74536
      COMMON/C3/Cu(10,28,2),NT(10,2),NF(10,2),NTMAX(2),PXY(28),FN(28)
                                                                               SUP74540
                                                                               SUP75050
      COMMON/C4/VPTC(1275),SS(2000),DQ(28,2),Q(10,10,3),PHIW(50),SPHI
      COMMON/C5/MOR(50), NBL(50), KC(50), KL(28), BSL(20), DXE(7), Tel, U
                                                                               SUP74560
      COMMON/C6/X,Y,Dx,UY,EM,EK,EKB,EKR,NP,MP,NB,NBOX,KODE,MODE,NBN,NBT
                                                                              SUP 74570
      COMMON/C7/CZERO,P4I,PHÍTE,DPHI,XL,NS,NTM,K,J,QR,QI,QAB,QAN,IFR,THESUP7458Ú
      COMMON/C8/RHO
                                                                               SUP74590
      XP = X
                                                                               SŨP74609
      IF(NS.EQ.2) XP = X - X3
                                                                               SUP74610
      PXY = 1.0
                                                                               SUP74620"
      10 \ 10 \ N = 2.28
                                                                               SUP74630.
   10 \text{ PXY(N)} = 0.0
                                                                               SUP74.64.0
      TM = NTMAX(NS)
                                                                               SUP/4650<
      ID = SQRT(2.0*TM) - 0.5
                                                                               SUP74660
                                                                               SUP74670
      TF(1D:EQ.0) GO TO 60
      K = 1
                                                                               SUP74680
      [F(XP.EQ.0.0) GO TO 40
                                                                               SUP74690
      YX = Y/XP
                                                                               SUP747.00
      PX = XP
                                                                               SUP74710
      DO 30 N = 1, In
                                                                               SUP74724
      K = K + 1
                                                                               SUP74730
      PXY(K) = PX
                                                                               SUP74740
      0020 M = 1.0
                                                                              SUP74750-
                                                                               SUP 74760
      \kappa = \kappa + 1.
   20 \text{ PXY(K)} = \text{PXY(K-1)} * \text{Y:X}
                                                                               SUP74770
                                                                               SUP74780
   5\pi PX = PX*XP
                                                                               SUP74790
      60'10 60
                                                                               SUP74800
   40 PX = 1.0
```

\$

10 50′ N₂ = 1, Th PXY(K) = PX

The same of

SUP74810

SUP74820

```
SUP74831
      K = K + N + 1
                                                                             SUP74841
   50 PX = PX*Y
   60 NTH = NT(HODE, NS)
                                                                             SUP74850
                                                                             SUP74860
      Z = CO(MODE, 1, NS)
                                                                             SUP74870
      DZ = U.0
                                                                             SUP74880
      TF(NTM.FQ.1) GO TO 80
      \hat{p}0 70 K = 2,NTH
                                                                             SUP74890
      7 = Z + PXY(K)*CO(MODE,K,NS)
                                                                             SUP74988
                                                                             SUP74910
      KK = KL(K)
   7\pi nZ = DZ + PXY(KK)*CU(MODE,K,NS)*FN(K)
                                                                             SUP74920
   Bn SS(NB) = U*GMPLX(DZ,EK*2)
                                                                             SUP74930
                                                                             SUP74949
      RETURN
                                                                             SUP74950
      FND
                                                                             SUP.74960
       FORTRAN HESTOU, DECK
CROAT.
                                                                             SUP74980
            POUT
      SUBPOUTINE POUT (IND)
                                                                             SÚP74990
      COMPLEX CZERO, VPIC, SS, DO, O, PHIN, SPHI, PHI, PHITE, DPHI
                                                                             SUP75000
      DIMENSION CARDS (25,50)
      DIMENSION SH(5,6), SURF(2,3), CUD(7), C(50)
                                                                             SUP/5010
      COMMON/C1/KHOX(2000);XE(5);XE(3);AR(3);X1;X2;X3;X4;Y1;Y2;BETA;NBS SUP/5020
      CUMMON/C2/AS.HMACH,FMACH(6),NFREQ,FREQ(10),NMODE,NSURF,LVPIC,LSSYPSUP/5030
      COMMO4/C3/CC(10,28,2),N1(10,2),NF(10,2),NTMAX(2),PXY(28),FN(28)
                                                                             SUP75848
      cummon/c4/VFTc(1275),S$(2000),D$(28,2),Q(10,10,3),PHTW(50),SPHT
                                                                             SUP75050
      COMMON/C5/MOB(50), NRL(50), KC(50), KL(28), BSL(20), DXE(7), API, U
                                                                             SUP75060
      COMMONZC6/X,Y,DX;0Y,EM;EK,EKB;EKR;NP;MP;NB;NBOX;KODE;MODE;NBY;NBT SUP75070
      COMMON/C7/C7ERO, PHI, PHITE, DPHI, XL, NS, NTH, K, J, OR, Q1, QAB, UAN, IFR, TWLSUP/508U
                                                                             SUP750.90
      COMMON/C8/REO
      DATA (SH(1,1),1=1,6)/26HMAP OF MACH BOX OVERLAY ON,
                                                                             SUP/5100
                            26HHING, TAIL, AND DIAPHRAGH,
                                                                             SUP75110
     2
                                         (S) - HING
                            26H
                                                                             SUP75120
     3
                             26H
                                          ($) - TAIL
                                                                             SUP 75130
                                         () - HAKE
                                                                             SUP75140
                             26H
                                          (a) - DIAPHRAGH
                                                                             SUP75150
                             26H
                                          JI'ATH8.
                                                                             SUP 75161
      ÑAĪA (SURF(1,[°),[=1,3)/8HWING
                                                     ,11HWING + TAIL /
      DATA COD/1H5,1H6,1H5,1H5,1H5,1H,,1H./
                                                                             SUP7517.0
      GO 10 (40 -28 -40 -40 -50 -60 -70 ). ÎÑĎ
                                                                             SUP/5180
   10 MRITE(6,11)FM,AS,RHU,XE(1),XE(4),X1,X4,Y1,Y2,Y2,Y2,X2,X4,AR(1),
                                                                             SUP75190
     1 AR(2), NBW, FBT, BS, NBS,
                                                                             SUP75200
   14 FORMAT(1817////30X,43HiAC/NAA HISŠILE SUPĖRSONIC ATRLOADS PROGRAHŠUP75210
     1 7//37X,30HFLIGHT CONDITIONS AND GEOMÉTRY/1HO//15X, 13HMACH NUMBERSUP75220
     2 =,F8.5,4X,16:ISPE::D: OF SOUND =F10.3,4H L/T,4X,4HRHO=,E14.8//1HO/
                                                                             SUP/5230
                                                                             SUP75240
     X54X,4HWING,18X,
     3 4HTAIL///22X,10HL.F. SIATION (L),2E22.3//22X,16HROOT CHORD
                                                                         (L), SUP/5250
     4 2F22.3// 22X315HL.F. SPAN
                                      (L),2F22.3//22X,16HT, E. SPAN
                                                                         (L)/SUP75260
     5 2F22,377 22X,16HTTP CHORD
                                      (L),2F22.3//22X,16HT0TAL AREA (L*L),SUP/527U
     6 2F22.3// 22X,16HCHORDWISE BOXES , 119, 122//22X,
                                                                             SUP75280
     /16HSPANNISE BOXES
                          ,119,122)
                                                                             SUP75290
      HRITE(6,12) "BOX, DX, NY
                                                                             SIIP 75300
   12 FORMAT(4HQ/,11X,23HTOFAL CHORDWISE BOXES =,13, 5X,11HBOX CHURD =, SUP75310
     1 1P1E12.5.20 L, 5X.10HBOX SPAN =,1P1E12.5.20 L/ )
                                                                             SUP75320
      HRITE(6,91)
                                                                             SUP75330
                                                                             SUP75340
      NB = 1
      DU 17 NP = J.NBUX
                                                                             SUP75350
      MB = MOB(NP)
                                                                             SUP75360
      [F(MB.GT.50)' G/) 10' 800
                                                                             SUP 75370
      DO 13 MP = 1,4B
                                                                             SUP75380
                                                                             SUP75390
      K = KBOX(NB)
      C(MF) = COD(K)
                                                                             SUP/75400
```

SUP/5410 SUP/5420

13 :NB = NB + 1

TF(NP.G4.6) SO TO 15

```
WRITE(6,14)(SH(1,NP),[=1,5),(C(MP),MP=1,MB)
                                                                           SUP75430
 14 FORHAT(10X,5A6,50A1)
                                                                           SUP75440
     60 10 17
                                                                           SUP75450
 15 HRITE(6,16): (C(MP), MP=1, MB)
                                                                           SUP75460
 16 FORMAT(40X;50A1)
                                                                           SUP7547.0
  17 CONTINUE
                                                                           SUP7,548U.
    GO TO 1000
                                                                           SUP75485
800 HRIJE(6,801)
                                                                           SUP75490
801 FORMAT(9X)52HRHEN MOB EXCEEDS 50 THE MAP PRINTING IS DISCONTINUED SUP75500.
                        CALCULATIONS PROCEED IN NORMAL MANNER
    1//1H0,48H
                                                                           SUP75510
     GO 70 1000
                                                                           SUP 75520
 20 HRITE(6,51)FREQ(IFR), NBOX, EKR
                                                                           SUP75530
     HRITE(6,21)EMREKB
                                                                           SUP75540
  21 FORMATCIH ,28x,48HPLANAR VELOCITY POTENTIAL INFLUENCE COEFFICIENTSSUP75550
    1 /1H0,30X,1HARACH NO. =,F8.5,10X, 6HKBAR =,F9.5/1H0,13X,1HI,5X,1HJSUP/5560
    2 10%,5HNUBÀF,5%;5HHUBAR,11%,14HREAL VPIC(I,J),8%,14H;MAG VPIC(I,J)SUP75570
    3º /1H 1
                                                                           SUP 75580
     \kappa = 0
                                                                           SUP75590
     DO 22 I = 1.0000
                                                                           SUP / 5600
     DO 22 J = 1.1.
                                                                           SUP75610
     84RNU = [ - 1
                                                                           SUP75620
     BARHU = J - 1
                                                                           SUP75630.
                                                                           SUP75640
  22 WRITE(6,23) I, J, BARKU, BARKU, VPIC(K)
                                                                           SUP75650.
  23 FORMAT(9X,216,4X,2F10.1,2X,1P2E22.5)
                                                                           SUP 75660
    -60 10 1000
                                                                           SUP 7.5670
  30 WRITE(6:51) FREUGIERY, NBOX, EKR-
                                                                          SUP75680
     WRITE(6,319MONE
                                                                           SUP75690
                      59PUPPER VELOCITY POTENTIALS AND SOURCE STRENGTHSSUP75700
  31 FURNATION .21X,
    1 FOR MODE NO. 137140, 9x, 14n, 6x, 14H, 5x, 2HNB, 7x, 10HR PHI (N, M), 7x, 10HI SUP75710
    2 PH1(M, H)10X, 9HR SS(N, H), 8X, 9HI SS(N, B)/1H )
                                                                           SUP75720
                                                                          SUP /5736
     GO 70 1000
     HRITE(6941)HP, MAS AB, PHI, SS(NB)
                                                                          SUP75740
  41 FORMAT(4X,317,122E17.5,3X,2P2E17.5)
                                                                          SUP/5750
     GO 10 1000
                                                                          SUP75760:
    IFGNS.FQ.3) GO TO 100
                                                                          SUP.75770
                                                                          SÚP75780
  50 WRITE(6,51)FREQUIFR); NBOX, EKR
 54 FORMATCIH1,33X,44HMISSILE SUPERSONIC AIRLOADS PROGRAM (CONTED)//
                                                                          SUP75790
    X1HO
                                                                          SUP75800
    1 8X,27HOSCYLLATURY FREQUENCY (CPS),F12.5,14X,12,25H BOXES IN CHORDSUP75810
    2 DIRECTION /100,8x,30HREDUCED FREQUENCY (SEMI CHORD),F9.5,14X,
                                                                          SUP75820
   3 23HFREE STREAM MACH NUMBER, F9.3,/1H 3
                                                                          SUP75830
     WRITE(6:101) SUKF(1.NS)
                                                                           SUP/5840
101 FORMAT(28X,45HIMPUT MODE SHAPE PÕLYNOMTAL CUEPFICIENTS FOR "A&/
                                                                           SUP/5850
    1 22X,62HREFFRFNCEN TO THE SURFACE LEADING EDGE-CENTERLINE INCERSECSUP75860
    2TION //2X,4HMODE,20x, 7HCOEFFS.)
                                                                          SUP75870
     DO 102 I=1, NHODE
                                                                           SUP7588U
     NTM=NT(L,NS)
                                                                           SUP75890
102 WRITE(6,103) [,(Cu(I;;,NS);J=1,NTM)
                                                                           SUP/5900
103 FORMAT(1H0; 14,4X, &P7E13.4/(9X,1P7E13.4))
                                                                           SUP 75910
-100 WRITE(6,51)FREQ(IFR),NBOX,EKR JEM
                                                                           SUP/5920
     WRITE(6,61)(SURF(L,NS), I=1,2)
                                                                           SUP759311
 61 FORMAT(1H ,35x,23HGENERALIZED FORCES FOR ,2A6/1H0,6x,4HDEFL,3x,
                                                                           SUP75940
    1 4HLOAD, 10X, 9HREAL PART, 10X, 9HIMAG PART, 10X, 9HABS VALUE, 10X,
                                                                           SUP/5950
    2 11HPHASE ANGLE //)
                                                                          SUP/596U
     60 10 1000
                                                                          SUP/5971
 JO HRITE(6,71)J,K, DR,QI,QAB,QAN
                                                                          SUP/5980
     IF (NSURF .EQ. 1) Gu [0 632
     IF (MS.NE.3) GO TO 1000
```

632 KKK=2\*NMOBE

NNN=2+K
NNNN=NNN-1
CARDS(J,NNN)=0P
CARDS(J,NNN)=0I
IF (J.NE-NHUBE) GU TO 1000
IF (K.NE-NHUBE) GU TO 1000
PUNCH 6969, ((CARUS(II,JJ),JJ=1,KKK), II=1,NHODE)

6969 FORMAT(6Ê12.5)
71 FORMAT(1H0, 19, I/, 2X, 193E19.5, 0PF16.3,4H DEG)
91 FORMAT(1H1,30x,44HMISSILE SUPERSONIC AIRLOADS PROGRAM (CONT-D)//) SUP76010
SUP76010

## REFERENCES

- 1. Bisplinghoff, R. L., Ashley, H., Halfman, R. L., Aeroelasticity, Addision Wesley Publishing Co. Inc., 1955.
- Bisplinghoff, RL. L., Ashley, H., Principles of Aeroelasticity, John Wiley and Son Inc., 1968.
- 3. Gravitz, S. T., "Analytical Procedure for Orthogonalization of Experimentally Measured Modes", Journal of the Agro Space Sciences, Vol. 25, No. 11, Nov. 1958, pp. 721-722.
- 4. McGrew, J., "Orthogonalization of Measured Modes and Calculation of Influence Coefficients", AIAA Journal, Vol. 7, No. 4, April 1969, pp. 774-776.
- 5. Vivian, H. T. and L. V. Andrew, "Masteady Aerodynamics for Advanced Configurations, Part I Application of the Subsonic Kernel Function to Nonplanar Lifting Surfaces", Air Force Flight Dynamics Laboratory Report FDL-TDR-64-152, Part I (1965).
- 6. Rodemich, E. R. and L. V. Andrew, "Unsteady Aerodynamics for Advanced Configurations, Part II A Transonic Box Method for Planar Lifting Surfaces", Air Force Flight Dynamics Laboratory Report FDL-TDR-64-152, Part II (1964).
- 7. Moore, M. T. and L. V. Andrew, "Unsteady Aerodynamics for Advanced Configurations, Part IV Application of the Supersonic Mach Box Method to Intersecting Planar Lifting Surfaces", Air Force Flight Dynamics Laboratory Report FDL-TDR-64-152, Part IV (1965).
- 8. Garrick, I. E. and S. I. Rubinow, "Theoretical Study of Air Force on an Oscillating or Steady Thin Wing in a Supersonic Main Stream", NACA Report 872 (1948).
- 9. Hsu, P. T., "Calculation of Pressure Distributions for Oscillating Wings of Arbitrary Planform in Substitute Flow by the Kernel Function Method, Part I", MIT Aeroelasticity and Structures Research Laboratory Technical Report 641-(1957).
- 10. MSD MAV 2.21.10-1, "Development/Qualification Test Report Modal Vibration," Data Item T-119, 15 Dec. 1969.
- 11. S. Pines, K. Dugundji, and J. Neuringer, "Aerodynamic Flutter Derivaties for a Flexible Wing with Supersonic and Subsonic Leading Edge," <u>Journal of the Aeronautical Sciences</u>, Volume 22, No. 10, October 1955.